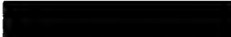




Test Report

No.:



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TIANJIN FUJI-TA BICYCLE INDUSTRIAL CO., LTD
FUSHIDA GROUP AERA DONGJIN ROAD JUNLIANGCHENG STREET DONGLI DISTRICT
TIANJIN

The following sample(s) was/were submitted and identified by the client as:

Sample Description : LIME BIKE
Sample Receiving Date : NOV.16, 2017
Testing Period : NOV.16, 2017 TO NOV.22, 2017
Test Performed : SELECTED TEST(S) AS REQUESTED BY APPLICANT
Test Requested : 16 CFR PART 1512: 2016- REQUIREMENTS FOR
BICYCLES EXCLUDING CLAUSE 1512.16(G)(H) AND
CLAUSE 1512.19
Test Result(s) : FOR FURTHER DETAILS, PLEASE REFER TO THE
FOLLOWING PAGE(S)
Conclusion : THE SUBMITTED SAMPLE MET THE TEST
REQUIREMENT OF REQUESTED TEST ITEMS.

Signed for and on behalf of
SGS-CSTC Standards Technical Services (Tianjin) Co., Ltd.

Michael Wen
Authorized Signatory



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Sample Description:

Maximum saddle height: 952mm

Wheels: 26" wheels

Speed: 3-speed

Brakes: Band brakes on front & rear

Reflectors: Clear reflector on front, red reflector on rear, clear wheel reflectors & amber pedal reflectors

Others: Basket equipped on front, quick-release device on seat tube

Test Conducted:

I. 16 CFR Part 1512:2016: Requirements for bicycles

1. Scope

The part sets forth the requirements for a bicycle as defined in § 1512.2(a) (except a bicycle that is a "track bicycle" or a "one-of-a-kind bicycle" as defined in § 1512.2 (d) and (e)) which is not a banned article under § 1500.18(a) (12) of this chapter.

2. Number of Tested Sample: 2 sets of packaged sample

3. Test Result

Clause	Test Item	Requirement/Test Method	Rating
1512.3	Requirement in general	Any bicycle subject to the regulations in this part shall meet the requirements of this part in the condition to which it is offered for sale to consumers; any bicycle offered for sale to consumers in 'disassembled or partially assembled condition shall meet these requirements after assembly according to the manufacturer's instructions. For the purpose of compliance with this part, where the metric and English units are not equal due to the conversion process the less stringent requirement will prevail.	Pass
1512.4	Mechanical requirements		
(a)	Assembly	Bicycles shall be manufactured such that mechanical skills required of the consumer for assembly shall not exceed those possessed by an adult of normal intelligence and ability.	Pass
(b)	Sharp edges	There shall be no unfinished sheared metal edges or other sharp parts on assembled bicycles that are, or may be, exposed to hands or legs; sheared metal edges that are not rolled shall be finished so as to remove any feathering of edges, or any burrs of spurs caused during the shearing process.	Pass
(c)	Integrity	There shall be no visible fracture of the frame or of any steering, wheel, pedal, crank, of brake system component resulting from testing in accordance with: the handbrake loading and performance test, §1512.18(d); the foot brake force and performance test, §1512.18 (e); and the load test, §1512 18 (p)	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		(or the sidewalk bicycle proof test, §1512.18 (q).	
(d)	Attachment hardware	All screws, bolts, or nuts used to attach or secure components shall not fracture, loosen, or otherwise fail their intended function during the tests required in this part. All threaded hardware shall be of sufficient quality to allow adjustments and maintenance.	Pass
(e)-(f)	[Reserved]		
(g)	Excluded area	There shall be no protrusions located within the area bounded by as specified by the standard. The top tube on a female bicycle model shall be the seat mast and the down tube or tubes that are nearest the rider in the normal riding position. Control cables no greater than 6.4 mm (1.4 in) in diameter and cable clamps made from material not thicker than 4.8 mm (3.16 in) may be attached to the top tube. Clamps or misalignment of brake components.	Pass
(h)	[Reserved]		
(i)	Control cable ends	Ends of all accessible control cables shall be provided with protective caps or otherwise treated to prevent unraveling. Protective caps shall be tested in accordance with the protective cap and end-mounted devices test, § 1512.18(c), and shall withstand a pull of 8.9 N (2.0 lbf).	Pass
(j)	Control cable abrasion	Control cables shall not abrade over fixed parts and shall enter and exit cable sheaths in a direction in line with the sheath entrance and exit so as to prevent abrading.	Pass
1512.5	Requirements for braking system		
(a)	Braking system	Bicycles shall be equipped with front and rear wheel brakes or rear wheel brakes only.	Pass
(b)	Handbrakes	Handbrakes shall be tested at least ten times by applying a force sufficient to cause the handlever to contact the handlebar, or a maximum of 445 N (100 lbf), in accordance with the loading test, § 1512.18(d)(2), and shall be rocked back and forth with the weight of a 68.1 kg (150 lb) rider on the seat with the same handbrake force applied in accordance with the rocking test, § 1512.18(d)(2)(iii); there shall be no visible fractures, failures, movement of clamps, or misalignment of brake components.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
	(1) Stopping distance	A bicycle equipped with only handbrakes shall be tested for stopping distance by a rider of at least 68.1 kg (150 lb) weight in accordance with the performance test, § 1512.18(d)(2) (v) and (vi), and shall have a stopping distance of no greater than 4.57 m (15 ft) from the actual test speed as determined by the equivalent ground speed specified in § 1512.18(d)(2)(vi).	Pass
	(2) Hand lever access	Hand lever mechanisms shall be located on the handlebars in a position that is readily accessible to the rider when in a normal riding position.	Pass
	(3) Grip dimension	The grip dimension (maximum outside dimension between the brake hand lever and the handlebars in the plane containing the centerlines of the handgrip and the hand brake lever) shall not exceed 89 mm (31.2 in) at any point between the pivot point of the lever and lever midpoint; the grip dimension for sidewalk bicycles shall not exceed 76 mm (3 in). The grip dimension may increase toward the open end of the lever but shall not increase by more than 12.7 mm (1.2 in) except for the last 12.7 mm (1.2 in) of the lever.	Pass
	(4) Attachment	Brake assemblies shall be securely attached to the frame by means of fasteners with locking devices such as a lock washer, locknut, or equivalent and shall not loosen during the rocking test, § 1512.18(d)- (2)(iii). The cable anchor bolt shall not cut any of the cable strands.	Pass
	(5) Operating force	A force of less than 44.5 N (10 lbf) shall cause the brake pads to contact the braking surface of the wheel when applied to the handlebar at a point 25 mm (1.0 in) from the open end of the handlebar.	Pass
	(6) Pad and pad holders	Caliper brake pad shall be replaceable and adjustable to engage the braking surface without contacting the tire or spokes and the pad holders shall be securely attached to the caliper assembly. The brake pad material shall be retained in its holder without movement when the bicycle is loaded with a rider of at least 68.1 kg (150 lb) weight and is rocked forward and backward as specified in the rocking test, § 1512.18(d)(2)(iii).	Pass
	(7)[Reserved]		



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Clause	Test Item	Requirement/Test Method	Rating
	(8) Hand lever location	The rear brake shall be actuated by a control located on the right handlebar and the front brake shall be actuated by a control located on the left handlebar. The left- hand/right-hand locations may be reversed in accordance with an individual customer order. If a single hand lever is used to actuate both front and rear brakes, it shall meet all applicable requirements for hand levers and shall be located on either the right or left handlebar in accordance with the customer's preference.	Pass
	(9) Hand lever extensions	Bicycles equipped with hand lever extensions shall be tested with the extension levers in place and the hand lever extensions shall also be considered to be hand levers.	N/A
(c)	Footbrakes	All footbrakes shall be tested in accordance with the force test, 1512.18 (e) (2), and the measured braking force shall not be less than 178 N (40 lbf) for an applied pedal force of 310 N (70 lbf)	N/A
	(1) Stopping distance	Bicycles equipped with footbrakes (except sidewalk bicycles) shall be tested in accordance with the performance test, § 1512.18(e)(3), by a rider of at least 68.1 kg (150 lb) weight and shall have a stopping distance of no greater than 4.57 m (15 ft) from an actual test speed of at least 16 km/h (10 mph). If the bicycle has a footbrake only and the equivalent groundspeed of the bicycle is in excess of 24 km/h (15 mph) (in its highest gear ratio at a pedal crank rate of 60 revolutions per minute), the stopping distance shall be 4.57 m (15 ft) from an actual test speed of 24 km/h (15 mph) or greater.	N/A
	(2) Operating force	Footbrakes shall be actuated by a force applied to the pedal in a direction opposite to that of the drive force, except where brakes are separate from the drive pedals and the applied force is in the same direction as the drive force.	N/A
	(3) Crank differential	The differential between the drive and brake positions of the crank shall be not more than 60 ° with the crank held against each position under a torque of no less than 13.6 N.m (10ft-lb).	N/A
	(4) independent	The brake mechanism shall function independently of any drive-gear positions or adjustments.	N/A



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Clause	Test Item	Requirement/Test Method	Rating
	operation		
(d)	Footbrakes and handbrakes in combination	Bicycles equipped with footbrakes and handbrakes shall meet all the requirements for footbrakes in § 1512.5(c), including the tests specified. In addition, if the equivalent ground speed of the bicycle is 24 km/h (15 mph) or greater, the actual test speed specified in § 1512.18(e)(3) shall be increased to 24 km/h (15 mph) and both braking systems may be actuated to achieve the required stopping distance of 4.57 m (15 ft).	N/A
(e)	Sidewalk bicycles		N/A
1512.6	Requirements for steering system		
(a)	Handlebar stem insertion mark	The handlebar stem shall contain a permanent ring or mark which clearly indicates the minimum insertion depth of the handlebar stem into the fork assembly. The insertion mark shall not affect the structural integrity of the stem and shall not be less than 2.5 times the stem diameter from the lowest point of the stem. The stem strength shall be maintained for at least a length of one shaft diameter below the mark.	Pass
(b)	Handlebar stem strength	The handlebar stem shall be tested for strength in accordance with the handlebar stem test, § 1512.18(g), and shall withstand a force of 2000 N (450 lbf) for bicycles and 1000 N (225 lbf) for sidewalk bicycles. § 1512.16(e)	Pass
(c)	Handlebar	Handlebars shall allow comfortable and safe control of the bicycle. Handlebar ends shall be symmetrically located with respect to the longitudinal axis of the bicycle and no more than 406 mm (16 in) above the seat surface when the seat is in its lowest position and the handlebar ends are in their highest position. This requirement does not apply to recumbent bicycles.	Pass
(d)	Handlebar ends	The ends of the handlebars shall be capped or otherwise covered. Handgrips, end plugs, control shifters, or other end-mounted devices shall be secure against a removal force of no less than 66.8 N (15 lbf) in accordance with the protective cap and end-mounted devices test, §1512.18(c).	Pass
(e)	Handlebar and clamps	The handlebar and clamps shall be tested in accordance with the handlebar test, § 1512.18(h). Directions for assembly of the bicycle required in the instruction manual by § 1512.19(a)(2) shall include an explicit warning about the danger of damaging the stem-to-fork assembly and the risk of injury to the rider that can result from overtightening the stem bolt or other clamping device.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		The directions for assembly shall also contain a simple, clear, and precise statement of the procedure to be followed to avoid damaging the stem-to- fork assembly when tightening the stem bolt or other clamping device.	
1512.7	Requirements for pedals		
(a)	Construction	Pedals shall have right-hand/left-hand symmetry. The tread surface shall be present on both top and bottom surfaces of the pedal except that if the pedal has a definite preferred position, the tread surface need only be on the surface presented to the rider's foot.	Pass
(b)	Toe clips	Pedals intended to be used only with toe clips shall have toe clips securely attached to them and need not have tread surfaces. Pedals designed for optional use of toe clips shall have tread surfaces.	N/A
(c)	Pedal reflectors	Pedals for bicycles other than sidewalk bicycles shall have reflectors in accordance with § 1512.16(e). Pedals for sidewalk bicycles are not required to have reflectors.	Pass
1512.8	Requirements for drive chain	The drive chain shall operate over the sprockets without catching or binding. The tensile strength of the drive chain shall be no less than 8010 N or 6230 N for sidewalk bicycles.	Pass
1512.9	Requirements for protective guards		
(a)	Chain guard	Bicycles having a single front sprocket and a single rear sprocket shall have a chain guard that shall cover the top strand of the chain and at least 90° of the perimeter where the drive chain contacts the drive sprocket. The chain guard shall extend rearward to a point at least 8 cm (3.2 in.) forward of the centerline of the rear axle. The minimum width of the top area of the chain guard shall be twice the width of the chain in that portion forward of the rear wheel rim. The rear part of the top area may be tapered. The minimum width at the rear of the guard shall be one-half the chain width. Such chain guard shall prevent a rod of 9.4 mm (3/8 in.) diameter and 76 mm (3.0 in.) length from entrapment between the upper junction of the chain and the sprocket when introduced from the chain side of the bicycle in any direction within 45° from a line normal to the sprocket.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
(b)	Derailleur guard	Derailleurs shall be guarded to prevent the drive chain from interfering with or stopping the rotation of the wheel through improper adjustments or damage.	N/A
1512.10	Requirements for tires	The manufacturer's recommended inflation pressure shall be molded into or onto the sidewall of the tire in lettering no less than 3.2 mm (1.8 in.) in height. The statement of recommended inflation pressure shall be in the English language utilizing Arabic numerals. After inflation to 110 percent of the recommended inflation pressure, the tire shall remain intact on the rim, including while being tested under a load of 2,000 N (450 lbf) in accordance with the rim test, § 1512.18(j). Tubular sew-up tires, nonpneumatic tires, and nonmolded wired-on tires are exempt from this section.	N/A



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Clause	Test Item	Requirement/Test Method	Rating
1512.11	Requirements for wheels		
(a)	Spokes	There shall be no missing spokes.	Pass
(b)	Alignment	The wheel assembly shall be aligned such that no less than 1.6 mm (1/16 in.) clearance exists between the tire and fork or any frame member when the wheel is rotated to any position.	Pass
(c)	Rims	Rims shall remain the spokes and tire when side-loaded with 2000 N (450 lbf) and tested in accordance with the rim test, § 1512.18(j). Sidewalk bicycles need not meet this requirement.	Pass
1512.12	Requirements for wheel hubs	All bicycle (other than sidewalk bicycles) shall meet the following requirement.	
(a)	Locking devices	Wheels shall be secured to the bicycle frame with a positive lock device. Locking devices on threaded axles shall be tightened to the manufacturer's specifications.	Pass
		(1) Rear wheels. There shall be no relative motion between the axle and the frame when a force of 1,780 N (400 lbf) is applied symmetrically to the axle for a period of 30 seconds in the direction of wheel removal.	Pass
		(2) Front wheels. Locking devices, except quick-release devices, shall withstand application of a torque in the direction of removal of 17 N-m (12.5 ft-lb).	Pass
(b)	Quick-released devices	(b) Quick-release devices. Lever-operated, quick-release devices shall be adjustable to allow setting the lever position for tightness. Quick-release levers shall be clearly visible to the rider and shall indicate whether the levers are in a locked or unlocked position. Quickrelease clamp action shall emboss the frame or fork when locked, except on fiber reinforced plastics.	N/A
(c)	Front hubs	Front hubs not equipped with lever-operated quick-release devices shall have a positive retention feature that shall be tested in accordance with the front hub retention test, § 1512.18(j)(3), to assure that when the locking devices are released the wheel will not separate from the fork.	Pass
1512.13	Requirements for front fork	The front fork shall be tested for strength by application of at least 39.5 J (350 in-lb) of energy in accordance with the fork test, § 1512.18(k)(1), without visible evidence of fracture. Sidewalk	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		bicycles need not meet this requirement.	
1512.14	Requirements for fork and frame assembly	The fork and frame assembly shall be tested for strength by application of a load of 890 N (200 lbf) or at least 39.5 J (350 in-lb) of energy, whichever results in the greater force, in accordance with the frame test, § 1512.18(k)(2), without visible evidence of fracture or frame deformation that significantly limits the steering angle over which the wheel can be turned. Sidewalk bicycles are exempt from this section.	Pass
1512.15	Requirements for seat		
(a)	Seat limitation	No part of the seat, seat supports, or accessories attached to the seat shall be more than 125 mm (5.0 in) above the top of the seat surface at the point where the seat surface is intersected by the seat post axis. This requirement does not apply to recumbent bicycles.	Pass
(b)	Seat post	The seat post shall contain a permanent mark or ring that clearly indicates the minimum insertion depth (maximum seat-height adjustment); the mark shall not affect the structural integrity of the seat post. This mark shall be located no less than two seat-post diameters from the lowest point on the post shaft, and the post strength shall be maintained for at least a length of one shaft diameter below the mark. This requirement does not apply to bicycles with integrated seat masts, however, a permanent mark or other means to clearly indicate that the seat or seat posts is safely installed shall be provided.	Pass
(c)	Adjustment clamps	The seat adjustment clamps shall be capable of securing the seat in any position to which it can be adjusted and preventing movement of the seat in any direction under normal conditions of use. Following the road test, § 1512.18(p) (or the sidewalk bicycle proof test, § 1512.18(q), as applicable), the seat clamps shall be tested in accordance with the seat adjustment clamps and load test, § 1512.18(l).	Pass
1512.16	Requirements for reflectors	Bicycles shall be equipped with reflective devices to permit recognition and identification under illumination from motor vehicle headlamps. The use of reflector combinations off the center plane of the bicycle (defined in § 1512.18(m)(2)) is acceptable if each reflector meets the requirements of this section and of § 1512.18 (m) and (n) and the combination of reflectors has a clear field of view of $\pm 10^\circ$ vertically and $\pm 50^\circ$ horizontally. Sidewalk bicycles	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		are not required to have reflectors.	
(a)	Front, rear, and pedal reflector	There shall be an essentially colorless front facing reflector, essentially colorless or amber pedal reflectors, and a red rear facing reflector.	Pass
(b)	Side reflector	There shall be retroreflective tire sidewalls or, alternatively, reflectors mounted on the spokes of each wheel, or, for non-caliper rim brake bicycles, retroreflective wheel rims. The center of spoke-mounted reflectors shall be within 76 mm (3.0 in.) of the inside of the rim. Side reflective devices shall be visible on each side of the wheel.	Pass
(c)	Front reflector	The reflector or mount shall not contact the ground plane when the bicycle is resting on that plane in any orientation. The optical axis of the reflector shall be directed forward within 5° of the horizontal-vertical alignment of the bicycle when the wheels are tracking in a straight line, as defined in § 1512.18(m)(2). The reflectors and/or mounts shall incorporate a distinct, preferred assembly method that shall insure that the reflector meets the optical requirements of this paragraph (c) when the reflector is attached to the bicycle. The front reflector shall be tested in accordance with the reflector mount and alignment test, § 1512.18(m).	Pass
(d)	Rear reflector	The reflector or mount shall not contact the ground plane when the bicycle is resting on that plane in any orientation. The reflector shall be mounted such that it is to the rear of the seat mast with the top of the reflector at least 76 mm (3.0 in) below the point on the seat surface that is intersected by the line of the seat post. The optical axis of the reflector shall be directed rearward within 5° of the horizontal-vertical alignment of the bicycle when the wheels are traveling in a straight line, as defined in § 1512.18(m)(2). The reflectors and/or mounts shall incorporate a distinct, preferred assembly method that shall insure that the reflector meets the optical requirements of this paragraph (d) when the reflector is attached to the bicycle. The rear reflector shall be tested in accordance with the reflector mount and alignment test, § 1512.18(m).	Pass



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Clause	Test Item	Requirement/Test Method	Rating
(e)	Pedal reflector	Each pedal shall have reflectors located on the front and rear surfaces of the pedal. The reflector elements may be either integral with the construction of the pedal or mechanically attached, but shall be sufficiently recessed from the edge of the pedal, or of the reflector housing, to prevent contact of the reflector element with a flat surface placed in contact with the edge of the pedal.	Pass
(f)	Side reflector	Reflectors affixed to the wheel spokes shall be mounted either flat on the spokes or within the spoke cage such that the angle between the optical axis and the normal to the plane of the wheel shall not exceed the angle of the spokes with the plane of the wheel. The reflectors shall not interfere with any wheel adjustments. The side-mounted reflector devices shall be essentially colorless or amber on the front wheel and essentially colorless or red on the rear wheel.	Pass
(g)	Reflector tests	The pedal, front-mount, rear-mount, and side-mount reflectors shall be tested in accordance with the reflector test, § 1512.18(n), to assure the reflectance values over the angles given in tables of the standard.	N/C
(h)	Retroreflective tire sidewalls	When retroreflective tire sidewalls are used in lieu of spoke-mounted reflectors, the reflecting material shall meet the requirements specified in the standard.	N/C
(i)	Retroreflective rims	When retroreflective rims are used in lieu of spoke-mounted reflectors or retroreflective tire sidewalls, the reflecting material shall meet the requirements specified in the standard.	N/A
1512.17	Other requirements		
(a)	Road test	Bicycles, other than sidewalk bicycles, shall be ridden at least 6.4 km (4.0 mi.) by a rider weighing at least 68.1kg (150 lb.) and travel five times over a 30.5 m (100 ft.) cleared course in accordance with the road test, § 1512.18(p), and shall exhibit stable handling, turning, and steering characteristics without difficulty of operation. There shall be no system or component failure of the structure, brakes, or tires, and there shall be no loosening or misalignment of the seat, handlebars, controls, or reflectors during or resulting from this test.	Pass
(b)	Sidewalk	Sidewalk bicycles shall be dropped a distance of at least 300 mm	N/A



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Clause	Test Item	Requirement/Test Method	Rating
	bicycle proof test	(1.0 ft.) three times onto a paved surface with weights attached in accordance with the sidewalk bicycle proof test, § 1512.18(q). There shall be no fracture of wheels, frame, seat, handlebars, or fork during or resulting from this test.	
(c)	Ground clearance	With the pedal horizontal and the pedal crank in its lowest position and any training wheels removed, it shall be possible to tilt the bicycle at least 25° from the vertical without the pedal or any other part (other than tires) contacting the ground plane.	Pass
(d)	Toe clearance	Bicycles not equipped with positive foot-retaining devices (such as toe clips) shall have at least 85 mm (3.1 in) clearance between the pedal and the front tire or fender (when turned to any position). The clearance shall be measured forward and parallel to the longitudinal axis of the bicycle from the center of either pedal to the arc swept by the tire or fender, whichever results in the least clearance.	Pass
1512.19	Instructions and labeling	A bicycle shall have an instruction manual attached to its frame or included with the packaged unit.	N/C
(a)	Instruction manual	The instruction manual shall include the specified the information as specified in the standard.	N/C
(b)	Information on shipping carton	A bicycle less than fully assembled and fully adjusted shall have clearly displayed on any promotional display material and on the outside surface of the shipping carton the following: (1) A list of tools necessary to properly accomplish assembly and adjustment. (2) A drawing illustrating the minimum leg-length dimension of a rider and a method of measurement of this dimension.	N/C
(c)	Requirement of the drawing of minimum leg-length dimension	The minimum leg-length dimension shall be readily understandable and shall be based on allowing no less than one inch of clearance between (1) the top tube of the bicycle and the ground plane and (2) the crotch measurement of the rider. A girl's style frame shall be specified in the same way using a corresponding boys' model as a basis.	N/C
(d)	[reserved]		
(e)	Information on bicycle frame	Every bicycle subject to the requirements of this part 1512 shall bear a marking or label that is securely affixed on or to the frame of the bicycle in such a manner that the marking or label cannot	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		be removed without being defaced or destroyed. The marking or label shall identify the name of the manufacturer or private labeler and shall also bear some form of marking from which the manufacturer can identify the month and year of manufacture or from which the private labeler can identify the manufacturer and the month and year of manufacture. For purposes of this paragraph, the term manufacture means the completion by the manufacturer of a bicycle of those construction or assembly operations that are performed by the manufacturer before the bicycle is shipped from the manufacturer's place of production for sale to distributors, retailers, or consumers.	

Note: N/A means not applicable.

N/C means not conducted as per client's requirement.



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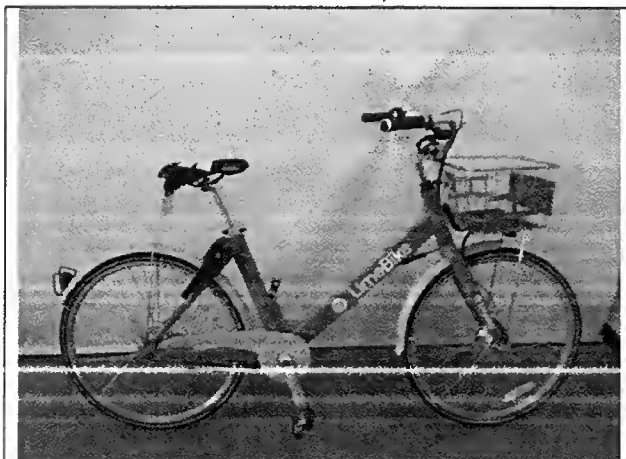
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Sample Photo:

Received Sample



SGS authenticate the photo on original report only

End of Report



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Test Report

No.:



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TIANJIN FUJI-TA BICYCLE CO., LTD

CHA JIN ROAD, SOUTH OF JUN LIANG CHENG, DONG LI DISTRICT, TIANJIN, CHINA

The following sample(s) was/were submitted and identified by the client as:

Sample Description : LIME BIKE
Sample Receiving Date : JUN.16, 2017
Testing Period : JUN.16, 2017 TO JUN.20, 2017
Test Performed : SELECTED TEST(S) AS REQUESTED BY APPLICANT
Test Requested : 16 CFR PART 1512: 2016- REQUIREMENTS FOR
BICYCLES EXCLUDING CLAUSE 1512.16(g)
Test Result(s) : FOR FURTHER DETAILS, PLEASE REFER TO THE
FOLLOWING PAGE(S)
Conclusion : THE SUBMITTED SAMPLE MET THE TEST
REQUIREMENT OF REQUESTED TEST ITEMS.

Signed for and on behalf of
SGS-CSTC Standards Technical Services (Tianjin) Co., Ltd.

Michael Wen
Section Head



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Test Report

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Sample Description:

Maximum saddle height: 920mm

Wheels: 26" wheels

Speed: 8- speed

Brakes: Band brakes on front & rear

Reflectors: Clear reflector on front, red reflector on rear, clear wheel reflectors & amber pedal reflectors

Others: Basket equipped on front

Test Conducted:

I. 16 CFR Part 1512:2016: Requirements for bicycles

1. Scope

The part sets forth the requirements for a bicycle as defined in § 1512.2(a) (except a bicycle that is a "track bicycle" or a "one-of-a-kind bicycle" as defined in § 1512.2 (d) and (e)) which is not a banned article under § 1500.18(a) (12) of this chapter.

2. Number of Tested Sample: 2 sets of packaged sample

3. Test Result

Clause	Test Item	Requirement/Test Method	Rating
1512.3	Requirement in general	Any bicycle subject to the regulations in this part shall meet the requirements of this part in the condition to which it is offered for sale to consumers; any bicycle offered for sale to consumers in disassembled or partially assembled condition shall meet these requirements after assembly according to the manufacturer's instructions. For the purpose of compliance with this part, where the metric and English units are not equal due to the conversion process the less stringent requirement will prevail.	Pass
1512.4	Mechanical requirements		
(a)	Assembly	Bicycles shall be manufactured such that mechanical skills required of the consumer for assembly shall not exceed those possessed by an adult of normal intelligence and ability.	Pass
(b)	Sharp edges	There shall be no unfinished sheared metal edges or other sharp parts on assembled bicycles that are, or may be, exposed to hands or legs; sheared metal edges that are not rolled shall be finished so as to remove any feathering of edges, or any burrs or spurs caused during the shearing process.	Pass
(c)	Integrity	There shall be no visible fracture of the frame or of any steering, wheel, pedal, crank, of brake system component resulting from testing in accordance with: the handbrake loading and performance test, §1512.18(d); the foot brake force and performance test, §1512.18 (e); and the load test, §1512.18 (p)	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		(or the sidewalk bicycle proof test, §1512.18 (q).	
(d)	Attachment hardware	All screws, bolts, or nuts used to attach or secure components shall not fracture, loosen, or otherwise fail their intended function during the tests required in this part. All threaded hardware shall be of sufficient quality to allow adjustments and maintenance.	Pass
(e)-(f)	[Reserved]		
(g)	Excluded area	There shall be no protrusions located within the area bounded by as specified by the standard. The top tube on a female bicycle model shall be the seat mast and the down tube or tubes that are nearest the rider in the normal riding position. Control cables no greater than 6.4 mm (1.4 in) in diameter and cable clamps made from material not thicker than 4.8 mm (3.16 in) may be attached to the top tube. Clamps or misalignment of brake components.	Pass
(h)	[Reserved]		
(i)	Control cable ends	Ends of all accessible control cables shall be provided with protective caps or otherwise treated to prevent unraveling. Protective caps shall be tested in accordance with the protective cap and end-mounted devices test, § 1512.18(c), and shall withstand a pull of 8.9 N (2.0 lbf).	Pass
(j)	Control cable abrasion	Control cables shall not abrade over fixed parts and shall enter and exit cable sheaths in a direction in line with the sheath entrance and exit so as to prevent abrading.	Pass
1512.5	Requirements for braking system		
(a)	Braking system	Bicycles shall be equipped with front and rear wheel brakes or rear wheel brakes only.	Pass
(b)	Handbrakes	Handbrakes shall be tested at least ten times by applying a force sufficient to cause the handlebar to contact the handlebar, or a maximum of 445 N (100 lbf), in accordance with the loading test, § 1512.18(d)(2), and shall be rocked back and forth with the weight of a 68.1 kg (150 lb) rider on the seat with the same handbrake force applied in accordance with the rocking test, § 1512.18(d)(2)(iii); there shall be no visible fractures, failures, movement of clamps, or misalignment of brake components.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
	(1) Stopping distance	A bicycle equipped with only handbrakes shall be tested for stopping distance by a rider of at least 68.1 kg (150 lb) weight in accordance with the performance test, § 1512.18(d)(2) (v) and (vi), and shall have a stopping distance of no greater than 4.57 m (15 ft) from the actual test speed as determined by the equivalent ground speed specified in § 1512.18(d)(2)(vi).	Pass
	(2) Hand lever access	Hand lever mechanisms shall be located on the handlebars in a position that is readily accessible to the rider when in a normal riding position.	Pass
	(3) Grip dimension	The grip dimension (maximum outside dimension between the brake hand lever and the handlebars in the plane containing the centerlines of the handgrip and the hand brake lever) shall not exceed 89 mm (31.2 in) at any point between the pivot point of the lever and lever midpoint; the grip dimension for sidewalk bicycles shall not exceed 76 mm (3 in). The grip dimension may increase toward the open end of the lever but shall not increase by more than 12.7 mm (1.2 in) except for the last 12.7 mm (1.2 in) of the lever.	Pass
	(4) Attachment	Brake assemblies shall be securely attached to the frame by means of fasteners with locking devices such as a lock washer, locknut, or equivalent and shall not loosen during the rocking test, § 1512.18(d) - (2)(iii). The cable anchor bolt shall not cut any of the cable strands.	Pass
	(5) Operating force	A force of less than 44.5 N (10 lbf) shall cause the brake pads to contact the braking surface of the wheel when applied to the handlever at a point 25 mm (1.0 in) from the open end of the handlever.	Pass
	(6) Pad and pad holders	Caliper brake pad shall be replaceable and adjustable to engage the braking surface without contacting the tire or spokes and the pad holders shall be securely attached to the caliper assembly. The brake pad material shall be retained in its holder without movement when the bicycle is loaded with a rider of at least 68.1 kg (150 lb) weight and is rocked forward and backward as specified in the rocking test, § 1512.18(d)(2)(iii).	Pass
	(7)[Reserved]		



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	(8) Hand lever location	The rear brake shall be actuated by a control located on the right handlebar and the front brake shall be actuated by a control located on the left handlebar. The left- hand/right-hand locations may be reversed in accordance with an individual customer order. If a single hand lever is used to actuate both front and rear brakes, it shall meet all applicable requirements for hand levers and shall be located on either the right or left handlebar in accordance with the customer's preference.	Pass
	(9) Hand lever extensions	Bicycles equipped with hand lever extensions shall be tested with the extension levers in place and the hand lever extensions shall also be considered to be hand levers.	N/A
(c)	Footbrakes	All footbrakes shall be tested in accordance with the force test, 1512.18 (e) (2), and the measured braking force shall not be less than 178 N (40 lbf) for an applied pedal force of 310 N (70 lbf)	N/A
	(1) Stopping distance	Bicycles equipped with footbrakes (except sidewalk bicycles) shall be tested in accordance with the performance test, § 1512.18(e)(3), by a rider of at least 68.1 kg (150 lb) weight and shall have a stopping distance of no greater than 4.57 m (15 ft) from an actual test speed of at least 16 km/h (10 mph). If the bicycle has a footbrake only and the equivalent groundspeed of the bicycle is in excess of 24 km/h (15 mph) (in its highest gear ratio at a pedal crank rate of 60 revolutions per minute), the stopping distance shall be 4.57 m (15 ft) from an actual test speed of 24 km/h (15 mph) or greater.	N/A
	(2) Operating force	Footbrakes shall be actuated by a force applied to the pedal in a direction opposite to that of the drive force, except where brakes are separate from the drive pedals and the applied force is in the same direction as the drive force.	N/A
	(3) Crank differential	The differential between the drive and brake positions of the crank shall be not more than 60 ° with the crank held against each position under a torque of no less than 13.6 N.m (10ft-lb).	N/A
	(4) independent	The brake mechanism shall function independently of any drive-gear positions or adjustments.	N/A



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Clause	Test Item	Requirement/Test Method	Rating
	operation		
(d)	Footbrakes and handbrakes in combination	Bicycles equipped with footbrakes and handbrakes shall meet all the requirements for footbrakes in § 1512.5(c), including the tests specified. In addition, if the equivalent ground speed of the bicycle is 24 km/h (15 mph) or greater, the actual test speed specified in § 1512.18(e)(3) shall be increased to 24 km/h (15 mph) and both braking systems may be actuated to achieve the required stopping distance of 4.57 m (15 ft).	N/A
(e)	Sidewalk bicycles		N/A
1512.6	Requirements for steering system		
(a)	Handlebar stem insertion mark	The handlebar stem shall contain a permanent ring or mark which clearly indicates the minimum insertion depth of the handlebar stem into the fork assembly. The insertion mark shall not affect the structural integrity of the stem and shall not be less than 2.5 times the stem diameter from the lowest point of the stem. The stem strength shall be maintained for at least a length of one shaft diameter below the mark.	Pass
(b)	Handlebar stem strength	The handlebar stem shall be tested for strength in accordance with the handlebar stem test, § 1512.18(g), and shall withstand a force of 2000 N (450 lbf) for bicycles and 1000 N (225 lbf) for sidewalk bicycles. § 1512.16(e)	N/A
(c)	Handlebar	Handlebars shall allow comfortable and safe control of the bicycle. Handlebar ends shall be symmetrically located with respect to the longitudinal axis of the bicycle and no more than 406 mm (16 in) above the seat surface when the seat is in its lowest position and the handlebar ends are in their highest position. This requirement does not apply to recumbent bicycles.	Pass
(d)	Handlebar ends	The ends of the handlebars shall be capped or otherwise covered. Handgrips, end plugs, control shifters, or other end-mounted devices shall be secure against a removal force of no less than 66.8 N (15 lbf) in accordance with the protective cap and end-mounted devices test, § 1512.18(c).	Pass
(e)	Handlebar and clamps	The handlebar and clamps shall be tested in accordance with the handlebar test, § 1512.18(h). Directions for assembly of the bicycle required in the instruction manual by § 1512.19(a)(2) shall include an explicit warning about the danger of damaging the stem-to-fork assembly and the risk of injury to the rider that can result from overtightening the stem bolt or other clamping device.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		The directions for assembly shall also contain a simple, clear, and precise statement of the procedure to be followed to avoid damaging the stem-to- fork assembly when tightening the stem bolt or other clamping device.	
1512.7	Requirements for pedals		
(a)	Construction	Pedals shall have right-hand/left-hand symmetry. The tread surface shall be present on both top and bottom surfaces of the pedal except that if the pedal has a definite preferred position, the tread surface need only be on the surface presented to the rider's foot.	Pass
(b)	Toe clips	Pedals intended to be used only with toe clips shall have toe clips securely attached to them and need not have tread surfaces. Pedals designed for optional use of toe clips shall have tread surfaces.	N/A
(c)	Pedal reflectors	Pedals for bicycles other than sidewalk bicycles shall have reflectors in accordance with § 1512.16(e). Pedals for sidewalk bicycles are not required to have reflectors.	Pass
1512.8	Requirements for drive chain	The drive chain shall operate over the sprockets without catching or binding. The tensile strength of the drive chain shall be no less than 8010 N or 6230 N for sidewalk bicycles.	Pass
1512.9	Requirements for protective guards		
(a)	Chain guard	Bicycles having a single front sprocket and a single rear sprocket shall have a chain guard that shall cover the top strand of the chain and at least 90° of the perimeter where the drive chain contacts the drive sprocket. The chain guard shall extend rearward to a point at least 8 cm (3.2 in.) forward of the centerline of the rear axle. The minimum width of the top area of the chain guard shall be twice the width of the chain in that portion forward of the rear wheel rim. The rear part of the top area may be tapered. The minimum width at the rear of the guard shall be one-half the chain width. Such chain guard shall prevent a rod of 9.4 mm (3.8 in.) diameter and 76 mm (3.0 in.) length from entrapment between the upper junction of the chain and the sprocket when introduced from the chain side of the bicycle in any direction within 45° from a line normal to the sprocket.	Pass



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Clause	Test Item	Requirement/Test Method	Rating
(b)	Derailleur guard	Derailleurs shall be guarded to prevent the drive chain from interfering with or stopping the rotation of the wheel through improper adjustments or damage.	Pass
1512.10	Requirements for tires	The manufacturer's recommended inflation pressure shall be molded into or onto the sidewall of the tire in lettering no less than 3.2 mm (1.8 in.) in height. The statement of recommended inflation pressure shall be in the English language utilizing Arabic numerals. After inflation to 110 percent of the recommended inflation pressure, the tire shall remain intact on the rim, including while being tested under a load of 2,000 N (450 lbf) in accordance with the rim test, § 1512.18(j). Tubular sew-up tires, nonpneumatic tires, and nonmolded wired-on tires are exempt from this section.	Pass



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1512.11	Requirements for wheels		
(a)	Spokes	There shall be no missing spokes.	Pass
(b)	Alignment	The wheel assembly shall be aligned such that no less than 1.6 mm (1/16 in.) clearance exists between the tire and fork or any frame member when the wheel is rotated to any position.	Pass
(c)	Rims	Rims shall remain the spokes and tire when side-loaded with 2000 N (450 lbf) and tested in accordance with the rim test, § 1512.18(j). Sidewalk bicycles need not meet this requirement.	Pass
1512.12	Requirements for wheel hubs	All bicycle (other than sidewalk bicycles) shall meet the following requirement.	
(a)	Locking devices	Wheels shall be secured to the bicycle frame with a positive lock device. Locking devices on threaded axles shall be tightened to the manufacturer's specifications.	Pass
		(1) Rear wheels. There shall be no relative motion between the axle and the frame when a force of 1,780 N (400 lbf) is applied symmetrically to the axle for a period of 30 seconds in the direction of wheel removal.	Pass
		(2) Front wheels. Locking devices, except quick-release devices, shall withstand application of a torque in the direction of removal of 17 N-m (12.5 ft-lb).	Pass
(b)	Quick-released devices	(b) Quick-release devices. Lever-operated, quick-release devices shall be adjustable to allow setting the lever position for tightness. Quick-release levers shall be clearly visible to the rider and shall indicate whether the levers are in a locked or unlocked position. Quickrelease clamp action shall emboss the frame or fork when locked, except on fiber reinforced plastics.	N/A
(c)	Front hubs	Front hubs not equipped with lever-operated quick-release devices shall have a positive retention feature that shall be tested in accordance with the front hub retention test, § 1512.18(j)(3), to assure that when the locking devices are released the wheel will not separate from the fork.	Pass
1512.13	Requirements for front fork	The front fork shall be tested for strength by application of at least 39.5 J (350 in-lb) of energy in accordance with the fork test, § 1512.18(k)(1), without visible evidence of fracture. Sidewalk	Pass



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		bicycles need not meet this requirement.	
1512.14	Requirements for fork and frame assembly	The fork and frame assembly shall be tested for strength by application of a load of 890 N (200 lbf) or at least 39.5 J (350 in-lb) of energy, whichever results in the greater force, in accordance with the frame test, § 1512.18(k)(2), without visible evidence of fracture or frame deformation that significantly limits the steering angle over which the wheel can be turned. Sidewalk bicycles are exempt from this section.	Pass
1512.15	Requirements for seat		
(a)	Seat limitation	No part of the seat, seat supports, or accessories attached to the seat shall be more than 125 mm (5.0 in) above the top of the seat surface at the point where the seat surface is intersected by the seat post axis. This requirement does not apply to recumbent bicycles.	Pass
(b)	Seat post	The seat post shall contain a permanent mark or ring that clearly indicates the minimum insertion depth (maximum seat-height adjustment); the mark shall not affect the structural integrity of the seat post. This mark shall be located no less than two seat-post diameters from the lowest point on the post shaft, and the post strength shall be maintained for at least a length of one shaft diameter below the mark. This requirement does not apply to bicycles with integrated seat masts, however, a permanent mark or other means to clearly indicate that the seat or seat posts is safely installed shall be provided.	Pass
(c)	Adjustment clamps	The seat adjustment clamps shall be capable of securing the seat in any position to which it can be adjusted and preventing movement of the seat in any direction under normal conditions of use. Following the road test, § 1512.18(p) (or the sidewalk bicycle proof test, § 1512.18(q), as applicable), the seat clamps shall be tested in accordance with the seat adjustment clamps and load test, § 1512.18(l).	Pass
1512.16	Requirements for reflectors	Bicycles shall be equipped with reflective devices to permit recognition and identification under illumination from motor vehicle headlamps. The use of reflector combinations off the center plane of the bicycle (defined in § 1512.18(m)(2)) is acceptable if each reflector meets the requirements of this section and of § 1512.18 (m) and (n) and the combination of reflectors has a clear field of view of $\pm 10^\circ$ vertically and $\pm 50^\circ$ horizontally. Sidewalk bicycles	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		are not required to have reflectors.	
(a)	Front, rear, and pedal reflector	There shall be an essentially colorless front facing reflector, essentially colorless or amber pedal reflectors, and a red rear facing reflector.	Pass
(b)	Side reflector	There shall be retroreflective tire sidewalls or, alternatively, reflectors mounted on the spokes of each wheel, or, for non-caliper rim brake bicycles, retroreflective wheel rims. The center of spoke-mounted reflectors shall be within 76 mm (3.0 in.) of the inside of the rim. Side reflective devices shall be visible on each side of the wheel.	Pass
(c)	Front reflector	The reflector or mount shall not contact the ground plane when the bicycle is resting on that plane in any orientation. The optical axis of the reflector shall be directed forward within 5° of the horizontal-vertical alignment of the bicycle when the wheels are tracking in a straight line, as defined in § 1512.18(m)(2). The reflectors and/or mounts shall incorporate a distinct, preferred assembly method that shall insure that the reflector meets the optical requirements of this paragraph (c) when the reflector is attached to the bicycle. The front reflector shall be tested in accordance with the reflector mount and alignment test, § 1512.18(m).	Pass
(d)	Rear reflector	The reflector or mount shall not contact the ground plane when the bicycle is resting on that plane in any orientation. The reflector shall be mounted such that it is to the rear of the seat mast with the top of the reflector at least 76 mm (3.0 in) below the point on the seat surface that is intersected by the line of the seat post. The optical axis of the reflector shall be directed rearward within 5° of the horizontal-vertical alignment of the bicycle when the wheels are traveling in a straight line, as defined in § 1512.18(m)(2). The reflectors and/or mounts shall incorporate a distinct, preferred assembly method that shall insure that the reflector meets the optical requirements of this paragraph (d) when the reflector is attached to the bicycle. The rear reflector shall be tested in accordance with the reflector mount and alignment test, § 1512.18(m).	Pass



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Test Report

No.: [REDACTED]

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Clause	Test Item	Requirement/Test Method	Rating
(e)	Pedal reflector	Each pedal shall have reflectors located on the front and rear surfaces of the pedal. The reflector elements may be either integral with the construction of the pedal or mechanically attached, but shall be sufficiently recessed from the edge of the pedal, or of the reflector housing, to prevent contact of the reflector element with a flat surface placed in contact with the edge of the pedal.	Pass
(f)	Side reflector	Reflectors affixed to the wheel spokes shall be mounted either flat on the spokes or within the spoke cage such that the angle between the optical axis and the normal to the plane of the wheel shall not exceed the angle of the spokes with the plane of the wheel. The reflectors shall not interfere with any wheel adjustments. The side-mounted reflector devices shall be essentially colorless or amber on the front wheel and essentially colorless or red on the rear wheel.	Pass
(g)	Reflector tests	The pedal, front-mount, rear-mount, and side-mount reflectors shall be tested in accordance with the reflector test, § 1512.18(n), to assure the reflectance values over the angles given in tables of the standard.	N/C
(h)	Retroreflective tire sidewalls	When retroreflective tire sidewalls are used in lieu of spoke-mounted reflectors, the reflecting material shall meet the requirements specified in the standard.	N/A
(i)	Retroreflective rims	When retroreflective rims are used in lieu of spoke-mounted reflectors or retroreflective tire sidewalls, the reflecting material shall meet the requirements specified in the standard.	N/A
1512.17	Other requirements		
(a)	Road test	Bicycles, other than sidewalk bicycles, shall be ridden at least 6.4 km (4.0 mi.) by a rider weighing at least 68.1kg (150 lb.) and travel five times over a 30.5 m (100 ft.) cleated course in accordance with the road test, § 1512.18(p), and shall exhibit stable handling, turning, and steering characteristics without difficulty of operation. There shall be no system or component failure of the structure, brakes, or tires, and there shall be no loosening or misalignment of the seat, handlebars, controls, or reflectors during or resulting from this test.	Pass
(b)	Sidewalk	Sidewalk bicycles shall be dropped a distance of at least 300 mm	N/A



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Test Report

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Clause	Test Item	Requirement/Test Method	Rating
	bicycle proof test	(1.0 ft.) three times onto a paved surface with weights attached in accordance with the sidewalk bicycle proof test, § 1512.18(q). There shall be no fracture of wheels, frame, seat, handlebars, or fork during or resulting from this test.	
(c)	Ground clearance	With the pedal horizontal and the pedal crank in its lowest position and any training wheels removed, it shall be possible to tilt the bicycle at least 25° from the vertical without the pedal or any other part (other than tires) contacting the ground plane.	Pass
(d)	Toe clearance	Bicycles not equipped with positive foot-retaining devices (such as toe clips) shall have at least 85 mm (3.1 in) clearance between the pedal and the front tire or fender (when turned to any position). The clearance shall be measured forward and parallel to the longitudinal axis of the bicycle from the center of either pedal to the arc swept by the tire or fender, whichever results in the least clearance.	Pass
1512.19	Instructions and labeling	A bicycle shall have an instruction manual attached to its frame or included with the packaged unit.	N/C
(a)	Instruction manual	The instruction manual shall include the specified the information as specified in the standard.	N/C
(b)	Information on shipping carton	A bicycle less than fully assembled and fully adjusted shall have clearly displayed on any promotional display material and on the outside surface of the shipping carton the following: (1) A list of tools necessary to properly accomplish assembly and adjustment. (2) A drawing illustrating the minimum leg-length dimension of a rider and a method of measurement of this dimension.	N/C
(c)	Requirement of the drawing of minimum leg-length dimension	The minimum leg-length dimension shall be readily understandable and shall be based on allowing no less than one inch of clearance between (1) the top tube of the bicycle and the ground plane and (2) the crotch measurement of the rider. A girl's style frame shall be specified in the same way using a corresponding boys' model as a basis.	N/C
(d)	[reserved]		
(e)	Information on bicycle frame	Every bicycle subject to the requirements of this part 1512 shall bear a marking or label that is securely affixed on or to the frame of the bicycle in such a manner that the marking or label cannot	Pass



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Clause	Test Item	Requirement/Test Method	Rating
		be removed without being defaced or destroyed. The marking or label shall identify the name of the manufacturer or private labeler and shall also bear some form of marking from which the manufacturer can identify the month and year of manufacture or from which the private labeler can identify the manufacturer and the month and year of manufacture. For purposes of this paragraph, the term manufacture means the completion by the manufacturer of a bicycle of those construction or assembly operations that are performed by the manufacturer before the bicycle is shipped from the manufacturer's place of production for sale to distributors, retailers, or consumers.	

Note: N/A means not applicable.

N/C means not conducted as per client's requirement.



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Test Report

No.:



Date: JUN.20, 2017 Page: 15 of 15

Sample Photo:

Received Sample



SGS authenticate the photo on original report only

End of Report



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Bikes

Scooters



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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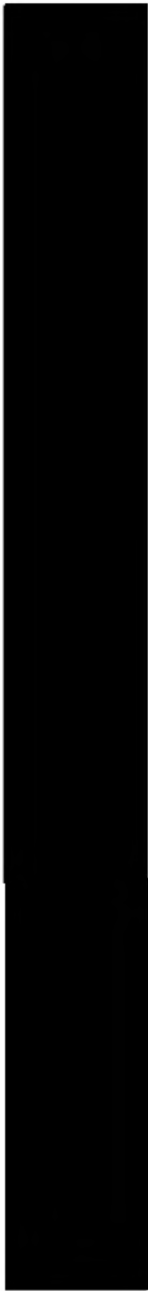
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]



Sign certificate acknowledgement

簽發證書最終確認表

Name and address of the Manufacturer	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang, China
Name and address of the Applicant (if it is necessary)	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang, China
Product Name	Electric Scooter
Trademark (if necessary)	/
Models (put it as written if necessary)	ES09, ES09-A, ES09-B, ES09-C, ES09-D, ES09-E, ES09-F, ES09-G
Directive and standard	MD+LVD+EMC: EN ISO 12100:2010, EN 60204-1:2006+A1:2009+AC:2010, EN 15194:2017, EN 12184:2014; EN 61000-6-1:2007, EN 61000-6-3:2007+A1:2011; EN 61000-3-2:2014; EN 61000-3-3:2013
REMARK	

NOTE: We will issue the certificate referring the above information, please pay attention the necessary information must be correct and accurate.

注意：我們將參考以上的基本資料簽發證書，請注意以上的資訊必須是正確和準確的。

2023

2023.7.2

日期 (Date)

Technical Construction File

**Test Report No. XMT0201704830L/MD
XMT0201704831L/LVD
XMT0201704832L/EMC**

According to Machinery Directive (2006/42/EC)
Electromagnetic Compatibility Directive (2014/30/EU)
Low Voltage Directive (2014/35/EU)

Related to the Electric Scooter

Model:ES09

Its variants and modifications:

ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G

Presented by

ZHEJIANG OKAI VEHICLE CO.,LTD
No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

Manufacturer

ZHEJIANG OKAI VEHICLE CO.,LTD
No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

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4.5 EN 61000-6-1:2007, EN 61000-6-3:2007+A1:2011, EN 61000-3-2:2014, EN 61000-3-3:2013 testreport

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Part I: General

1.1 General description

1.1 General description

The **Electric Scooter** do not belong to the machinery listed in Annex IV of 89/392/EEC, the machinery safety directive.

Summary of the regulations and standards the machinery complies with

- The machines must accord to the following EC Directives:
- Machinery Directive:2006/42/EC
EN ISO 12100:2010
Safety of machinery - general principles for design - risk assessment and risk reduction (Iso12100:2010)
EN 60204-1:2006+A1:2009+AC:2010
Safety of Machinery – Electrical Equipment of Machines - Part 1: General requirements
Low Voltage Directive 2014/35/EU
EN 12184:2014 test report
Electrically powered wheelchairs, scooters and their chargers — Requirements and test methods
EN 15194:2017 test report
Cycles - Electrically power assisted cycles - EPAC Bicycles
- Electromagnetic Compatibility Directive 2014/30/EU
EN 61000-6-1:2007
Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments.
EN 61000-6-3-2007+A1:2011
Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
EN 61000-3-2:2014
Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current Less than or equal to 16 A per phase)
EN 61000-3-3:2013
Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current Less than or equal to 16 A per phase and not subject to conditional connection

The test reports for these applicable standards in detail have been included in the relevant sub-clauses of this technical construction file.

1.1 Variations of the series products

Regarding the whole family of the series, they are:

ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G

To present the conformity of this series machine with Machinery Directive, we discuss the conformity systematically with the relative Directive and standards for **ES09** as a basic evaluation in clause.

Part II: Declarations

2.1 The CE Declaration of Conformity with signature



Declaration of Conformity



According to the following Directives

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility 2014/53/EU

We ZHEJIANG OKAI VEHICLE CO.,LTD

No. 1, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang, China

Declare that the machines mentioned hereafter

Product: Electric Scooter

Model: ES09, ES09-A, ES09-B, ES09-C, ES09-D, ES09-E, ES09-F, ES09-G

Provided that it is used and maintained in accordance with the generally accepted codes of good practice and the recommendations of the manufacturer, meets the essential safety and health requirements of the Machinery Directive, Electromagnetic Compatibility Directive, Low Voltage Directive. For the more specific rules of the machine safety and compliance with the essential requirements of the Directive has been based on standards of

EN ISO 12100:2010, EN 60204-1:2006+A1:2009+AC:2010,
EN 15194:2017, EN 12184:2014,
EN 61000-6-1:2007, EN 61000-6-3:2007+A1:2011,
EN 61000-3-2:2014, EN 61000-3-3:2013

Name: 
Qualification: Q Manager
Date of issue: Feb 04, 2018

Part II: Assessment of conformity

3.1 Risk assessment

3.2 Essential health and safety requirements

3.1 Risk assessment

TEST REPORT

Risk Assessment

Name and address of the testing laboratory	Shanghai Ximo Testing Technology Co.,Ltd NO.5131, CHUANNANFENG ROAD, PUDONG NEW AREA, SHANGHAI, CHINA		Tel: 02158100937 Fax: 02158100927
Name and address of the Applicant	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Name and address of the manufacturer	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Name and address of the Factory (production sites)	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Product	Electric Scooter		
Model/type reference	ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G		
Rating and principal Characteristics	See the appended page		
Test Result	See Test Report		
Test report no.	XMT0201704830L/MD,XMT0201704831L/LVD,XMT0201704832L/EMC		
Work carried out by		Signature	
	G. Manager		
Work verified by	Peter	Signature	
	Manager		
Date of issue	Feb.01,2018		

I .Introduction.

In general this risk assessment report for the **Electric Scooter** Model:**ES09**.series and its variants made by**ZHEJIANG OKAI VEHICLE CO.,LTD.** was carried out in accordance with the requirements of Machinery Directive and the standards of EN ISO 12100: 2010+AC:2011and ISO 14121-2:2012, in which an explicit risk level is evaluated with 4 factors described in next clause.

After the first assessment, some measures to eliminate the risks are given for the modification of machine or of relative documents with taking into account the explicit C-type EN standard or related B-type standard.

While taking appropriate provisions for the existing risks, the procedures and principles to eliminate the risk according to the most general B-type standard for any kind of machine, EN 292-part I , are followed, i.e.:

- First step: consider the possibility of eliminating risk at design stage.
- Second step: if impossible, protect the dangerous zone with appropriate design of safety guard or safety device.
- Third step: If above impossible, give warning signs to draw attention of operators about the residual risks.

In addition, some check list drawn from the explicit C-type EN standards, which are found suitable for or near the characteristic of this machine, are used to help developing the provisions for the elimination of the risks.

Finally the risk assessment was carried out again to ensure this machine and its relative documents are totally compliance with the Machinery Directive.

II. Risk assessment Methodology

This risk assessment report is based on the methods mentioned in the EN ISO 12100: 2010+AC:2011 and ISO 14121-2 standards, and the 4 factors S-F-O-A have been used for evaluating the level of risks.

(a) S: Severity of possible harm

- S1: Slight (normally reversible)
- S2: Serious (normally irreversible)

(b) F: Exposure

- F1: Seldom
- F2: Frequent

(c) O: Probability of occurrence of the hazardous event

- O1: Very low
- O2: Medium
- O3: High

(d) A: Probability of avoidance

- A1: Possible
- A2: Impossible

		Risk index calculation					
		O1		O2		O3	
		A1	A2	A1	A2	A1	A2
S1	F1	1				2	
	F2						
S2	F1	2		3		4	
	F2	3	4	5	6		

- a) a risk index of 1 or 2 corresponds to the lowest risk,
- b) a risk index of 3 or 4 corresponds to a medium risk, and
- c) a risk index of 5 or 6 corresponds to the highest risk.

Solutions for the level of hazards

- 1: Protected by warning sign
- 2: Protected by guard and warning sign
- 3: Consider the other design, choose the best one, and add both guard and warning sign
- 4: Consider another two designs, choose the best one, and add both guard and warning sign
- 5: Consider another three designs, choose the best one, and add both guard and warning sign

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No.	Hazards source	S	F	O	A	Level
Mechanical hazards						
1.0-1	Mechanical hazards due to machine parts or work pieces	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
1.0-2	Mechanical hazards due to accumulation of energy inside the machinery	<i>SI</i>	<i>F2</i>	<i>O1</i>	<i>A1</i>	-
1.1	Crushing/Squeezing					N/A
1.2	Shearing					N/A
1.3	Cutting or severing					N/A
1.4	Entanglement					N/A
1.5	Drawing-in or trapping					N/A
1.6	Impact	<i>S2</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
1.7	Stabbing or puncture					N/A
1.8	Friction or abrasion	<i>S2</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
1.9	High pressure fluid injection or ejection					N/A
Electrical hazards						
2.1	Contact with live parts	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.2	Contact with parts which have become live under faulty conditions	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.3	Approach to live part under high voltage	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.4	Electrostatic phenomena	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.5	Thermal radiation or other phenomena such as projection of molten particles and chemical effects from short-circuits, overloads etc.					N/A
Thermal hazards						
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
3.2	Damage to health by hot or cold working environment					N/A
Hazards generated by noise						
4.1	Hearing loss (deafness), other physiological disorders	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
4.2	Interference with speech communication, acoustic signals, etc.	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Hazards generated by vibration						
5.1	Use of hand-held machines resulting in a variety of neurological and vascular disorder					N/A
5.2	Whole body vibration, particular when combined with poor postures					N/A
Hazards generated by radiation						

6.1	Low frequency, radio frequency radiation, microwaves					N/A
6.2	Infrared, visible and ultraviolet light					N/A
6.3	X and gamma rays					N/A
6.4	Alpha, beta rays, electron or ion beams, neutrons					N/A
6.5	Lasers					N/A
Hazards generated by materials and substances processed or used by the machinery						
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
7.2	Fire and explosion hazard					N/A
7.3	Biological and micro-biological (viral or bacterial) hazards					N/A
Hazards generated by neglecting ergonomic principles in machine design						
8.1	Unhealthy postures or excessive effort					N/A
8.2	Inadequate consideration of hand-arm or foot-leg anatomy					N/A
8.3	Neglected use of personal protection equipment	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
8.4	Inadequate local lighting					N/A
8.5	Mental overload or underload, stress					N/A
8.6	Human error, human behavior	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
8.7	Inadequate design, location or identification of manual controls	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	N/A
8.8	Inadequate design or location of visual display units					N/A
Combination of hazards						
9	Combination of hazards					N/A
Unexpected start-up, unexpected overrun/over-speed						
10.1	Failure/disorder of the control system	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
10.2	Restoration of energy supply after an interruption	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
10.3	External influences on electrical equipment	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
10.4	Other external influences (gravity, wind, etc.)					N/A
10.5	Errors in the software					N/A
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Impossibility of stopping the machine in the best possible conditions						
11	Impossibility of stopping the machine in the best possible conditions					N/A
Variations in the rotational speed of tools						
12	Variations in the rotational speed of tools					N/A
Failure of the power supply						
13	Failure of the power supply	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-

Failure of the control circuit						
14	Failure of the control circuit	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
Errors of fitting						
15	Errors of fitting	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
Break-up during operation						
16	Break-up during operation	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
Falling or ejected objects or fluids						
17	Falling or ejected objects or fluids					N/A
Loss of stability / overturning of machinery						
18	Loss of stability / overturning of machinery					N/A
Slip, trip and fall of persons (related to machinery)						
19	Slip, trip and fall of persons (related to machinery)					N/A
Additional hazards, hazardous situations and hazardous events due to mobility						
20	Relating to the traveling function					
20.1	Movement when starting the engine	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
20.2	Movement without a driver at the driving position					N/A
20.3	Movement without all parts in a safe position					N/A
20.4	Excessive speed of pedestrian controlled machinery					N/A
20.5	Excessive oscillations when moving	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilized					N/A
Linked to the work position (including driving station) on the machine						
21.1	Fall of persons during access to (or at/from) the work position					N/A
21.2	Exhaust gases/lack of oxygen at the work position					N/A
21.3	Fire (flammability of the cab, lack of extinguishing means)					N/A
21.4	Mechanical hazards at the work position: a) contact with the wheels; b) rollover; c) fall of objects, penetration by objects; d) break-up of parts rotating at high speed; e) contact of persons with machine parts or tools (pedestrian controlled machines).	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
21.5	Insufficient visibility from the work positions					N/A
21.6	Inadequate lighting					N/A
21.7	Inadequate seating					N/A
21.8	Noise at the work position	<i>SI</i>	<i>FI</i>	<i>OI</i>	<i>AI</i>	-
21.9	Vibration at the work position					N/A
21.10	Insufficient means for evacuation/emergency exit					N/A

Due to the control system						
22.1	Inadequate location of manual controls					N/A
22.2	Inadequate design of manual controls and their mode of operation					N/A
From handling the machine (lack of stability)						
23	From handling the machine (lack of stability)					N/A
Due to the power source and to the transmission of power						
24.1	Hazards from the engine and the batteries	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
24.2	Hazards from transmission of power between machines					N/A
24.3	Hazards from coupling and towing					N/A
From/to third persons						
25.1	Unauthorized start-up/use	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
25.2	Drift of a part away from its stopping position					N/A
25.3	Lack or inadequacy of visual or acoustic warning means					N/A
Insufficient instructions for the driver/operator						
26	Insufficient instructions for the driver/operator	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Additional hazards, hazardous situations and hazardous events due to lifting						
27	Mechanical hazards and hazardous events					
27.1	From load falls, collisions, machine tipping caused by:					
27.1.1	Lack of stability	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
27.1.2	Uncontrolled loading - overloading - overturning moments exceeded					N/A
27.1.3	Uncontrolled amplitude of movements					N/A
27.1.4	Unexpected/unintended movement of loads					N/A
27.1.5	Inadequate holding devices/accessories					N/A
27.1.6	Collision of more than one machine					N/A
27.2	From access of persons to load support					N/A
27.3	From derailment					N/A
27.4	From insufficient mechanical strength of parts					N/A
27.5	From inadequate design of pulleys, drums					N/A
27.6	From inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine					N/A
27.7	From lowering of the load under the control of friction brake					N/A
27.8	From abnormal conditions of assembly/testing/use/maintenance					N/A
27.9	From the effect of load on persons (impact by load or	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-

	counterweight)					
Electrical hazards						
28.1	From lightning					N/A
Hazards generated by neglecting ergonomic principles						
29.1	Insufficient visibility from the driving position	SI	F1	O1	A1	-
Additional hazards, hazardous situations and hazardous events due to underground work						
30	Mechanical hazards and hazardous events due to:					
30.1	Lack of stability of powered roof supports					N/A
30.2	Failing accelerator or brake control of machinery running on rails					N/A
30.3	Failing or lack of deadman's control of machinery running on rails					N/A
31	Restricted movement of persons					N/A
32	Fire and explosion					N/A
33	Emission of dust, gases etc.	SI	F1	O1	A1	-
Additional hazards, hazardous situations and hazardous events due to the lifting or moving of persons						
34	Mechanical hazards and hazardous events due to:					
34.1	Inadequate mechanical strength - inadequate working coefficients					N/A
34.2	Failing of loading control					N/A
34.3	Failing of controls in person carrier (function, priority)					N/A
34.3	Overspeed of person carrier					N/A
35	Falling of person from person carrier					N/A
36	Falling or overturning of person carrier					N/A
37	Human error, human behavior					N/A

NOTE: "N/A" means that the hazard is not required to assess.

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No.	Hazards source	S	F	O	A	Level
1.1	Crushing	<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	<i>Work place</i>					
When	<i>during operation</i>					
Improvement result						
Method		S	F	O	A	Level
1. Use the movable guard with interlocking.		<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2. Read instruction manual before operate the machine.						
3. Affixing suitable warning signs.manual.						

No.	Hazards source	S	F	O	A	Level
2.1	Contact with live parts	<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	<i>Whole power and control systems</i>					
When	<i>The machine is power on</i>					
Improvement result						
Method		S	F	O	A	Level
1.Only operation by training/authorized persons.		<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.Operation of the machine shall conform to the instructions of the instruction manual.						
3.Check and inspection according to the specified durations of the instruction manual.						
4.Using safety components in accordance with those relevant international standards.						
5.Use of warning label.						

No.	Hazards source	S	F	O	A	Level
2.2	Contact with parts which have become live under faulty conditions	<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	<i>Whole power and control systems</i>					
When	<i>The machine is power on</i>					
Improvement result						
Method		S	F	O	A	Level

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1. Only operation by training/authorized persons.		<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2. Operation of the machine shall conform to the instructions of the instruction manual.						
3. Check and inspection according to the specified durations of the instruction manual.						
4. Using safety components in accordance with those relevant international standards.						
5. Use of warning label.						
No.	Hazards source	S	F	O	A	Level
10.3	External influences on electrical equipment	<i>S2</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	All electrical equipments equipped on the machine					
When	Working of the electrical equipments					
Improvement result						
Method		S	F	O	A	Level
1. Whole machine has been submitted to carry out the EMC testing according to relevant EN standards (e.g EN 55011, EN 50081-2 and EN 50082-2 etc.).		<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2. Connection of protective earthing indeed.						
3. Excellent electrical shielded housing.						
No.	Hazards source	S	F	O	A	Level
14	Failure of the control circuit	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	Control circuit/control components					
When	During operation of the machine					
Improvement result						
Method		S	F	O	A	Level
1.Checking before operation.		<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2.Make reference to the instruction manual before operate this machine.						
3.Daily/periodic inspection and maintenance.						
No.	Hazards source	S	F	O	A	Level
25.1	Unauthorised start-up/use	<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	Control system					
When	Operation, adjustment or maintenance of the machine					
Improvement result						
Method		S	F	O	A	Level
1. Always starting the machine by training/authorized persons.		<i>SI</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2. During adjustment or maintenance, put a warning nameplate near the working area.						
3. Lock the power switch of the machine.						

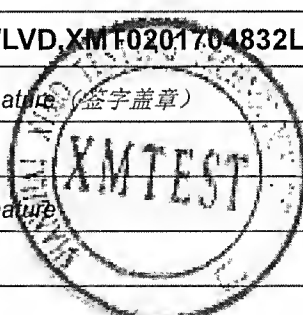
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No.	Hazards source	S	F	O	A	Level
26	Insufficient instructions for the driver/operator	<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
Where	<i>Whole machine</i>					
When	<i>Installation, assembly/disassembly, operation, adjustment or maintenance of the machine</i>					
Improvement result						
Method		S	F	O	A	Level
1. Edit the instruction manual in conformity with those requirement of Machinery Directive and EN 292-2 standard.		<i>S1</i>	<i>F1</i>	<i>O1</i>	<i>A1</i>	-
2. Each machine accompanied with a complete instruction manual.						

TEST REPORT

ESHR 2009

Name and address of the testing laboratory	Shanghai Ximo Testing Technology Co.,Ltd NO.5131, CHUANNANFENG ROAD, PUDONG NEW AREA, SHANGHAI, CHINA		Tel: 02158100937 Fax: 02158100927
Name and address of the Applicant	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Name and address of the manufacturer	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Name and address of the Factory (production sites)	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China		
Product	Electric Scooter		
Model/type reference	ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G		
Rating and principal Characteristics	See the appended page		
Test Result	See Test Report		
Test report no.	XMT0201704830L/MD,XMT0201704831L/LVD,XMT0201704832L/EMC		
Work carried out by			
	G. Manager		
Work verified by	Peter	Signature	
	Manager		
Date of issue	Feb.01,2018		

Clause	Requirement - test	Verdict
1	Essential health and safety requirements	-
1.1	General remarks	-
1.1.1	Definitions	-
1.1.2	Principles of safety integration	-
a)	Machinery must be constructed that it is fitted for its function, and can be adjusted and maintained without putting person at risk when these operations are carried out under the conditions foreseen by the manufacturer	Pass. Enough protection is provided.
	The aim of measures taken must be to eliminate any risk of accident throughout the foreseeable lifetime of the machinery, including the phases of assembly and dismantling, even where risks of accident arise from foreseeable abnormal situations	Pass. These requirements have been complied with.
b)	In selecting the most appropriate methods, the manufacturer must apply the following principles, in the order given:	-
	- eliminate or reduce risks as far as possible	Pass Manufacturer has provided enough safety devices to eliminate or reduce risks.
	- take the necessary protection measure in relation to risks that can't be eliminated	Pass. Safety guards and other devices are used.
	- inform users of the residual risks due to any shortcomings of the protection measures adopted, indicate whether any particular training is required and specify any need to provide personal protection equipment	Pass. Enough warnings are provided in the appropriate spot
c)	When designing and constructing machinery, and when drafting the instruction, the manufacturer must envisage not the normal use of the machinery but also uses which could reasonably be expected	Pass. All the conditions are considered by the manufacturer, and the related information also has been provided within the instruction manual
	The machinery must be designed to prevent abnormal use if such use would engender a risk In other cases the instructions must draw the user's attention to ways which experience has shown might occur-in which the machinery should not be used	Pass. These requirements have been complied with, and the related information also has been provided within the instruction manual.
d)	Under the intended conditions of use, the discomfort, fatigue and psychological stress faced by the operator must be reduced to the minimum possible taking ergonomic principles into account	Pass. These requirements have been taken into account during the design of this machine.
e)	When designing and constructing machinery, the manufacturer must take account of the constraints to which the operator is subject as a result of the necessary	Pass. These requirements have been taken into account during the design of this

Clause	Requirement - test	Verdict
	or foreseeable use of personal protection equipment	machine.
f)	Machinery must be supplied with all the essential special equipment and accessories to enable it to be adjusted, maintained and used without risk	Pass. All the essential special equipment and related accessories have been supplied.
1.1.3	Materials and products	-
	The materials used to construct machinery or products used and created during its use must not endanger exposed persons' safety or health	Pass. They cannot endanger exposed person's safety or health.
	In particular, where fluids are used, machinery must be designed and constructed for use without risks due to filling, use, recovery or draining	Not applicable.
1.1.4	Lighting	-
	The manufacturer must supply integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity	Pass. There is no risk when there is no integral lighting.
	The manufacturer must ensure that, there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects due to the lighting provided by the manufacturer	Pass. There is no this kind of risk has been found.
	Internal parts requiring frequent inspection, and adjustment and maintenance areas, must be provided with appropriate lighting	Pass. The appropriate lighting has been provided in the specified areas;.
1.1.5	Design of machinery to facilitate its handling	-
	Machinery or each component part thereof must:	-
	- be capable of being handle safely	Pass. Enough measures have been taken to ensure the safe of the handling.
	- be packaged or designed so that it can be stored safely and without damage	Pass. The machine can be stored in wood box safely and without damage.
	Where the weight, size or shape of machinery or its various component parts prevents them from being moved by hand, the machinery or each components part must:	-
	- either be fitted with attachments for lifting gear, or	Not applicable.
	- be designed so that it can be fitted with such attachments, or	Not applicable.
	- be shaped in such a way that standard lifting gear can easily be attached	Not applicable.
	Where machinery or one of its component parts is to be moved by hand, it must:	-
	- either be easily movable, or	Not applicable.

Clause	Requirement - test	Verdict
	- be equipped for picking up and moving in complete safety	Not applicable.
	Special arrangement must be made for the handling of tools and/or machinery parts, even if lightweight, which could be dangerous	Not applicable.
1.2	Controls	-
1.2.1	Safety and reliability of control systems	-
	Control systems must be designed and constructed so that they are safe and reliable, in a way that will prevent a dangerous situation arising	Pass. The control system for this machine is safe and reliable by appropriate designing
	Above all they must be designed and constructed:	-
	- they can withstand the rigors of normal use and external factors	Pass. The control system can withstand related effects during normal operation.
	- errors in logic don't lead to dangerous situations	Pass. Any error in logic doesn't lead to dangerous situations.
1.2.2	Control devices	-
	Control devices must be:	-
	- clearly visible and identifiable and appropriately marked where necessary	Pass. Appropriate labels and markings are provided. This requirement has been complied with.
	- positioned for safe operation without hesitation or loss of time, and without ambiguity	Pass. Appropriate positions have been taken into account during design.
	- designed so that the movement of the control is consistent with its effect	Not applicable
	- located outside the danger zones, except for certain controls where necessary, such as emergency stop, console for training of robots	Pass. All control devices have been located outside the danger zones.
	- positioned or that their operation can't cause additional risk	Pass. All operation of control devices won't cause additional risk.
	- designed or protected so that the desired effect, where a risk is involved, can't occur without an intentional operation	Pass. Appropriate safety devices have been used to comply with this requirement.
	- made so as to withstand foreseeable strain, particular attention must be paid to emergency stop devices liable to be subjected to considerable strain	Pass. The emergency stop and other control devices have enough strength to withstand foreseeable strain.
	Where a control is designed and constructed to perform	Not applicable

Clause	Requirement - test	Verdict
	several different actions, namely where there is no one-to-one correspondence, the action to be performed must be clearly displayed and subject to confirmation where necessary	
	Controls must be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles	Pass. These requirements have been taken into account during design.
	Constraints due to the necessary foreseeable use of personal protection equipment must be taken into account	Not applicable.
	Machinery must be fitted with indicators as required for safe operation	Pass. The indicators have been provided.
	The operator must be able to read them from the control position	Pass. The indicators are clearly visible in the control position.
	From the main control position the operator must be able to ensure that there are no exposed persons in the danger zones	Pass. The danger zones are visible for the operator in the main control position.
	If this is impossible, the control system must be designed and constructed so that an acoustic and/or visual warning signal is given whenever the machinery is about to start	Not applicable.
	The exposed person must have the time and the means to take rapid action to prevent the machinery starting up	Pass. Emergency stop, main switch and other related devices have been provided for the exposed person.
1.2.3	Starting	-
	It must be possible to start machinery only by voluntary actuation of a control provided for the purpose	Pass. Devices preventing unintended starting have been provided.
	The same requirement applies:	-
	- when restarting the machinery after stoppage, whatever the cause	Pass. Reset is necessary before restarting.
	- when effecting a significant change in the operating conditions	Pass. These requirements have been complied with.
	Unless such restarting or change in operating conditions is without risk to exposed persons	-
	This essential requirement doesn't apply to the restarting of the machinery or to the change in operating conditions resulting from the normal sequence of an automatic cycle	Pass. These requirements have been complied with by appropriate design.
	Where machinery has several starting controls and the operators can therefore put each other in danger, additional devices must be fitted to rule out such risks	Pass. An interlocking device is provided to eliminate these risks.
	It must be possible for automated plant functioning in	Pass.

Clause	Requirement - test	Verdict
	automatic mode to be restarted easily after a stoppage once the safety conditions have been fulfilled	These requirements have been complied with by appropriate design.
1.2.4	Stopping device	-
	Normal stopping	-
	Each machine must be fitted with a control whereby the machine can be brought safety to a complete stop	Pass. A normal stop control has been provided.
	Each workstation must be fitted with a control to stop some or all of the moving parts of the machinery, depending on the type of hazard, so that the machinery is rendered safe	Pass. A normal stop control has been provided.
	The machinery's stop control must have priority over the start controls	Pass. It has priority over the start control.
	Once the machinery or its dangerous parts have stopped, the energy supply to the actuators concerned must be cut off	Pass. The stops belong to the category 0, or category 1 stops.
	Emergency stop	-
	Each machinery must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted	Pass. One emergency stop is provided.
	The following exceptions apply:	-
	- machines in which an emergency stop device would not lessen the risk, either because it would not reduce the stopping time or because it would not enable the special measures required to deal with the risk to be taken	Not applicable
	The emergency stop device must:	-
	- have clearly identifiable, clearly visible and quickly accessible controls	Pass. The emergency stop has red button, yellow background and marked with "emergency stop"
	- stop the dangerous process as quickly as possible, without creating additional hazards	Pass. The emergency stop will stop the machine as soon as it is pressed and it will not create any additional hazards.
	- where necessary, trigger or permit the triggering of certain safeguard movements	Not applicable
	Once active operation of the emergency stop control has ceased following a stop command, that command must be sustained by engagement of the emergency stop device until that engagement is specifically overridden	Pass. After the action of the emergency stop machine can not be restarted until reset the emergency stop.
	It must be possible to disengage the device only by an appropriate operation, and disengaging the device must not restart the machinery but only permit restarting	Pass. Operator should turn the emergency stop to disengage the device.

Clause	Requirement - test	Verdict
	Complex installations	-
	In the case of machinery or parts of machinery designed to work together, must so design and construct the machinery that the stop controls, including the emergency stop, can stop not only the machinery itself but also all equipment upstream and/or downstream if its continued operation can be dangerous	Not applicable.
1.2.5	Mode selection	-
	The control mode selected must override all other control systems with the exception of the emergency stop	Pass The emergency stop is effective regardless of operating modes.
	If machinery has been designed and built to allow for its use in several control or operating modes presenting different safety levels, it must be fitted with a mode selector which can be locked in each position	Not applicable. No this kind of mode selection has been found.
	Each position of the selector must correspond to a single operating or control mode	Not applicable. No this kind of mode selection has been found.
	The selector may be replaced by another selection method which restricts the use of certain functions of the machinery or certain categories of operator	Not applicable. No this kind of mode selection has been found.
	If, for certain operations, the machinery must be able to operate with its protection devices neutralized, the mode selector must simultaneously:	Not applicable. No this kind of mode selection has been found.
	- disable the automatic control mode	Not applicable.
	- permit movements only by controls requiring sustained action	Not applicable.
	- permit the operation of dangerous moving parts only in enhanced safety conditions while preventing hazards from linked sequences	Not applicable.
	- prevent any movement liable to pose a danger by acting voluntarily or involuntarily on the machine's internal sensors	Not applicable.
	In addition, the operator must be able to control operation of the parts he is working on at the adjustment point	Not applicable. No this kind of mode selection has been found.
1.2.6	Failure of the power supply	-
	The interruption, re-establishment after an interruption or fluctuation in whatever manner of the power supply to the machinery must not lead to a dangerous situation	Pass. No any dangerous situation has been found.
	In particular:	-
	- the machinery must not start unexpectedly	Pass. Reset is necessary before restarting the machine

Clause	Requirement - test	Verdict
	- the machinery must not be prevented from stopping if the command has already been given	Pass. The stop command has the priority over all other devices
	- no moving part of the machinery or piece held by the machinery must fall or be ejected	Pass. No such part is found.
	- automatic or manual stopping of the moving parts whatever they may be must be unimpeded	Pass. Stopping of the moving parts is always effective.
	- the protection devices must remain fully effective	Pass. The protection devices remain effective after the failure of the power supply.
1.2.7	Failure of the control circuit	-
	A fault in the control circuit, or failure of or damage to the control circuit must not lead to dangerous situations	Pass. No dangerous situation is found.
	In particular:	-
	- the machinery must not start unexpectedly	Pass. Reset is necessary before restarting the machine.
	- the machinery must not be prevented from stopping if the command has already been given	Pass. The stop command has the priority over all other devices
	- no moving part of the machinery or piece held by the machinery must fall or be ejected	Pass. No such part is found.
	- automatic or manual stopping of the moving parts whatever they may be must be unimpeded	Pass. Stopping of the moving parts is always available.
	- the protection device must remain fully effective	Pass. The protection devices remain effective after the failure of the control circuit
1.2.8	Software	-
	Interactive software between the operator and the command or control system of a machine must be user-friendly	Pass. Ergonomic principles are taken into account in design the interactive software
1.3	Protection against mechanical hazards	-
1.3.1	Stability	-
	Machinery, components and fittings there of must be so designed and constructed that they are stable enough, under the foreseen operating conditions for use without risk of overturning, falling or unexpected movement	Pass. These requirements have been taken into account design
	If the shape of the machinery itself or its intended installation doesn't offer sufficient stability, appropriate	Not applicable. The sufficient stability has been

Clause	Requirement - test	Verdict
	means of anchorage must be incorporated and indicated in the instructions	offered for this machine.
1.3.2	Risk of break-up during operation	-
	The various parts of machinery and their linkages must be able to withstand the stress to which they are subject when used when as foreseen by the manufacturer	Pass. All parts of the machine can withstand related stress when they are used.
	The durability of the materials used must be adequate for the nature of the workplace foreseen by the manufacturer, in particular as regards the phenomena of fatigue, aging, corrosion and abrasion	Pass. All materials used for this machine are appropriate for their intended use and have adequate life.
	The manufacturer must indicate in the instructions the type and frequency of inspection and maintenance required for safety reasons, where appropriate, indicate the parts subject to wear and the criteria for replacement	Pass. The related information have been provided within the instruction manual.
	Where a risk of rupture or disintegration remains despite the measures taken the moving parts must be mounted and positioned in such a way that in case of rupture their fragments will be contained	Not applicable. No such risk is possible.
	Both rigid and flexible pipes carrying fluids, particularly those under high pressure, must be able to withstand the foreseen internal and external stresses and must be firmly attached and/or protected against all manner of external stresses and strains, precaution must be taken to ensure that no risk is posed by a rupture	Not applicable.
	Where the material to be processed is fed to the tool automatically, the following conditions must be fulfilled to avoid risks to the persons exposed:	-
	- when the work piece comes into contact with the tool the later must have attained its normal working conditions	Not applicable.
	- when the tool starts and/or stops the feed movement and the tool movement must be coordinated	Not applicable.
1.3.3	Risked due to falling or ejected objects	-
	Precautions must be taken to prevent risks from falling or ejected object	Not applicable.
1.3.4	Risks due to surfaces, edges or angles	-
	In so far as their purpose allows, accessible parts of the machinery must have no sharp edges, no sharp angles, and no rough surfaces likely to cause injury	Pass. No this kind injury has been found.
1.3.5	Risks related to combined machinery	-
	Where the machinery is intended to carry out several different operations with the manual removal of the piece between each operation, it must be designed and constructed in such a way as to enable each element to	Not applicable. No this kind of combined machinery.

Clause	Requirement - test	Verdict
	be used separately without the other element constituting a danger or risk for the exposed person	
	For this purpose, it must be possible to start and stop separately and elements that are not protected	Not applicable. No this kind of combined machinery.
1.3.6	Risks relating to variations in the rotation speeds of tools	-
	When the machine is designed to perform operations under different conditions of use, it must be designed and constructed in such a way that selection and adjustment of these conditions can be carried out safely and reliably	Not applicable.
1.3.7	Prevention of risks related to moving parts	-
	The moving parts of machinery must be designed, built and laid out to avoid hazards or, where hazards persist, fixed with guards or protective devices in such a way as to prevent all risk of contact which could lead to accidents	Pass. This kind of hazards have been prevented by appropriate guards.
	All necessary steps must be taken to prevent accidental blockage of moving parts involved in the work	Pass. All necessary steps have been taken.
	In cases where, despite the precaution taken, a blockage is likely to occur, specific protection devices or tools, the instruction handbook and possibly a sign on the machinery should be provided by the manufacturer to enable the equipment to be safely unblocked	Not applicable. No this kind of need.
1.3.8	Choice of protection against risk related to moving parts	-
	Guards or protection devices used to protect against the risks related to moving parts must be selected on the basis of the type of risk	Pass. It is in accordance with the risk assessment.
	The following guidelines must be used to help make the choice	-
	Moving transmission parts. Guards designed to protect exposed persons against the risks associated with moving transmission parts must be:	-
	- either fixed, complying with requirements 1.4.1 and 1.4.2.1 or	See the related clauses.
	- movable, complying with requirements 1.4.1 and 1.4.2.2.A	See the related clauses.
	A. Moving parts directly involved in the process Guards or protection devices designed to protect exposed persons against the risks associated with moving parts contributing to the work must be:	-
	- wherever possible fixed guards complying with requirements 1.4.1 and 1.4.2.1	See the related clauses.
	- otherwise, movable guards complying with requirements 1.4.1 and 1.4.2.2.B or protection devices	See the related clauses.

Clause	Requirement - test	Verdict
	such as sensing devices, remote-hold protection devices, or protection devices intended automatically to prevent all part of the operator's body from encroaching to the danger zone in accordance with requirements 1.4.1 and 1.4.3	
	However, when certain moving parts directly involved in the process can't be completely or partially inaccessible during operation owing to operations requiring near-by operator intervention, where technically possible such parts must be fitted with:	
	- fixed guards, complying with requirements 1.4.1 and 1.4.2.1 preventing access to those sections of the parts that are not used in the work	See the related clauses.
	- adjustable guards, complying with requirements 1.4.1 and 1.4.2.3 restricting access to those sections of the moving parts that are strictly for the work	See the related clauses.
1.4	Required characteristics of guards and protection devices	-
1.4.1	General requirement	-
	Guards and protection devices must:	-
	- be of robust construction	Pass. All the guards have enough strength.
	- not give rise to any additional risk	Pass. No additional risk is found.
	- not be easy to bypass or render non-operational	Pass. All the guards can't be bypassed or rendered non-operational by design.
	- be located at an adequate distance from the danger zone	Pass. All the guards comply with the safety distances.
	- cause minimum obstruction to the view in the production process	Pass. Transparent materials are used to make guards.
	- enable essential work to be carried out on installation and/or replacement of tools and also for maintenance by restricting access only to the area where the work has to be done, if possible without the guard or protection device having to be dismantled	Pass. These requirements have been taken into account during design.
1.4.2	Special requirements for guards	-
1.4.2.1	Fixed guards	-
	Fixed guard must be securely held in place	Pass. They all be securely held in place by appropriate fixation.
	They must be fixed by system that can be opened only with tools	Pass. They all can be opened only with

Clause	Requirement - test	Verdict
		tools.
	Where possible, guards must be unable to remain in place without their fixings	Not applicable.
1.4.4.2	Movable guards	-
	A. Type A movable guards must:	-
	- as far as possible remain fixed to the machinery when open	Pass. Gemels are used to satisfy this requirement.
	- be associated with a locking device to prevent moving parts starting up as these parts can be accessed and to give a stop command whenever they are no longer closed	Pass. Interlocking switch is provided.
	B. Type B movable guards must be designed and incorporated into the control system so that	Not applicable. No this kind of guard has been used.
	- moving parts can't start up while they are within the operator's reach	Not applicable.
	- the exposed person can't reach moving parts once they have started up	Not applicable.
	- they can be adjusted only by means of an intentional action, such as the use of a tool, etc.	Not applicable.
	- the absence or failure of one of their components prevents starting or stops the moving parts	Not applicable.
	- protection against any risk of ejection is provided by means of an appropriate barrier	Not applicable.
1.4.2.3	Adjustable guards restricting access	-
	Adjustable guards restricting access to those areas of the moving parts strictly necessary for the work must:	Not applicable. No this kind of guard has been used.
	- be adjustable manually or automatically according to the type of work involved	Not applicable.
	- be readily adjustable without the use of tools	Not applicable.
	- reduce as far as possible the risk of ejection	Not applicable.
1.4.3	Special requirements for protection devices	-
	Protection devices must be designed and incorporated into the control system so that:	-
	- moving parts can't start up while they are within the operator's reach	Pass. These requirements have been taken into account during design.
	- the exposed person can't reach moving parts once they have started up	Pass. Appropriate guards have been provided.
	- they can be adjusted only by means of an intentional action, such as the use of a tool, etc.	Pass. These requirements have been taken into account during design.
	-the absence or failure of one of their components	Pass.

Clause	Requirement - test	Verdict
	prevents starting or stops the moving parts	These requirements have been taken into account during design.
1.5	Protection against other hazards	-
	Electricity supply	-
	Where machinery has an electricity supply it must be designed, constructed and equipped so that all hazards of an electrical nature are or can be prevented	Pass. See the EN 60204-1 test report in detail.
	The specific rules in force relating to electrical equipment designed for use within certain voltage limits must apply to machinery which is subject to those limits	Pass. See the EN 60204-1 test report in detail.
1.5.2	Static electricity	-
	Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous electrostatic charges and/or be fitted with a discharging system	Pass. See the EN 60204-1 test report in detail.
1.5.3	Energy supply other than electricity	-
	Where machinery is powered by an energy other than electricity, it must be so designed, constructed and equipped as to avoid all potential hazards associated with these types of energy	Pass. No any additional hazard has been found for energy supply.
1.5.4	Error of fitting	-
	Errors likely to be made when fitting or refitting certain parts which could be a source of risk must be made impossible by the design of such parts or, failing this, by information on moving parts and/or their housing where the direction of movement must be known to avoid a risk	Pass. These requirements have been taken into account during design.
	Any further information that may be necessary must be given in the instructions	Pass. The related information has been provided within the instruction manual.
	Where a faulty connection can be the source of risk, incorrect fluid connections, including electrical conductors, must be made impossible by the design or, failing this, by information given on the pipes, cables, etc. and/or connectors blocks	Pass. All related information have been provided within the instruction manual. Necessary labels and markings have been provided.
1.5.5	Extreme temperatures	-
	Step must be taken to eliminate any risk of injury caused by contact with or proximity to machinery parts or materials at high or very low temperatures	Pass. Sufficient safety protection for extreme temperatures has been provided.
	The risk of hot or very cold materials being ejected should be assessed. Where this risk exists, the necessary steps must be taken to prevent it or, if this is not technically possible, to render it non-dangerous	Not applicable. No this kind of risk exists.
1.5.6	Fire	-

Clause	Requirement - test	Verdict
	Machinery must be designed and constructed to avoid all risk of fire or overheating posed by the machinery itself or by gases, liquids, dusts, vapors or the other substances produced or used by the machinery	Pass. The design and construction of this machine are in conformity with these requirements.
1.5.7	Explosion	-
	Machinery must be designed and constructed to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dusts, vapors or other substances produced or used by the machinery	Not applicable. No such risk is exist
	To that end the manufacturer must take steps to:	-
	-avoid a dangerous concentration of products	Not applicable.
	- prevent combustion of the potentially explosive atmosphere	Not applicable.
	-minimize any explosion which may occur so that it doesn't endanger the surroundings	Not applicable.
	The same precautions must be taken if the manufacturer foresees the use of the machinery in potentially explosive atmosphere	Not applicable. This machine is not intended to be used in potentially explosive atmosphere.
	Electrical equipment forming part of the machinery must conform, as far as the risk from explosion is concerned, to the provision of the specific Directive in force	Pass. See the 60204-4 test report in detail.
1.5.8	Noise	-
	Machinery must be so designed and constructed that risks resulting from the emission of airborne noise are reduced to the lowest level taking accounting of technical progress and the availability of means of reducing noise, in particular at source	Pass. The design and construction of this machine are in conformity with this requirement. Noise of this machine is not more than 75db.
1.5.9	Vibration	-
	Machinery must be so designed and constructed that risks resulting from the vibrations produced by the machinery are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source	Pass. The design and construction of this machine are in conformity with this requirement. Vibrations of this machine will not create any risk.
1.5.10	Radiation	-
	Machinery must be so designed and constructed that any emission of radiation is limited to the extent necessary for its operation and that the effects on exposed persons non-existent or reduced to non-dangerous proportions	Pass. The design and construction of this machine are in conformity with this requirement.
1.5.11	External radiation	-
	Machinery must be so designed and constructed that external radiation doesn't interfere with its operation	Pass. The machine can withstand the external radiation by appropriate design and construction

Clause	Requirement - test	Verdict
1.5.12	Laser equipment	-
	Where laser equipment is used, the following provisions should be taken into account;	Not applicable. No laser equipment has been used.
	- laser equipment on machinery must be designed and constructed so as to prevent any accidental radiation	Not applicable.
	- laser equipment on machinery must be protected so that effective radiation, radiation produced by reflection or diffusion and secondary radiation don't damage health	Not applicable.
	- optical equipment for the observation or adjustment of laser equipment on machinery must be such that no health risk is created by the laser rays	Not applicable.
1.5.13	Emission of dust, gases, etc	-
	Machinery must be so designed, constructed and/or equipped that risk due to gases, liquids, dust, vapors and other waste materials which it produces can be avoided	Not applicable. No such risk is exist
	Where a hazard exists, the machinery must be so equipped that the said substances can be contained and/or evacuated	Not applicable
	Where machinery is not enclosed during normal operation, the devices for containment and/or evacuation must be situated as close as possible to the source emission	Not applicable.
1.5.14	Risk of being trapped in a machine	-
	Machinery must be so designed, constructed or fitted with a means of preventing a exposed person from being enclosed within it or, if that is impossible, with a means of summoning held	Pass. The appropriate measure has been provided for this machine.
1.5.15	Risk of slipping, tripping or falling	-
	Parts of the machinery where persons are liable to move about or stand must be designed and constructed to prevent persons slipping, tripping or falling on or off these parts	Not applicable
1.6	Maintenance	-
1.6.1	Machinery maintenance	-
	Adjustment, lubrication And maintenance points must be located outside danger zones	Pass. The design and construction of this machine are in conformity with this requirement.
	It must be possible to carry out adjustment, Maintenance, repair, cleaning and servicing Operations while machinery is at a standstill	Pass. Maintnace, repair, cleaning and servicing, operations can only be implemented while machinery is at a standstill

Clause	Requirement - test	Verdict
	If one or more of the above conditions can't be satisfied for technical reasons, operations must be possible without risk	Not applicable. No this kind of situation.
	In the case of automated machinery and, where necessary, other machinery, the manufacturer must take provision for a connecting device for mounting diagnostic fault-finding equipment	Pass. Some adequate provisions have been taken.
	Automated machine components which have to be changed frequently, in particular for a change in manufacture or where they are liable to wear or likely to deteriorate following an accident, must be capable of being removed and replaced easily and in safety	Pass. The related parts can be removed and replaced easily and in safety.
	Access to the components must enable these tasks to be carried out with the necessary technical means in accordance with an operating method specified by the manufacturer	Pass. All operation methods have been specified by the manufacturer.
1.6.2	Access to operating position and servicing points	-
	The manufacturer must provide means of access to allow access in safety to all areas used for production, adjustment and maintenance operations	Pass. Appropriate guards and safety control devices have been used.
1.6.3	Isolation of energy sources	-
	All machinery must be fitted with means to isolate it from all energy sources	Pass. The power switch has been used.
	Such isolators must be clearly identified	Pass. It has passed CE
	They must be capable of being locked if reconnection could endanger exposed persons	Not applicable.
	In the case of machinery supplied with electricity through a plug capable of being plugged into a circuit, separation of the plug is sufficient	Not applicable.
	The isolator must be capable of being locked also where an operator is unable, from any of the points to which he has access, to check that the energy is still cut off	Pass. The isolator can be locked in the off position.
	After the energy is cut off, it must be possible to dissipate normally any energy remaining or stored in the circuits of the machinery without risk to exposed persons	Pass. All the parts will not be live after the energy is cut off.
	As an exception to the above requirement, certain circuits may remain connected to their energy source in order, for example, to hold parts, protect information, light interiors, etc. In this case, special steps must be taken to ensure operator safety	Not applicable. No this kind of situation.
1.6.4	Operator intervention	-
	Machinery must be so designed, constructed and equipped that the need for operator intervention is limited	Pass. The design and construction of this machine are in conformity with these

Clause	Requirement - test	Verdict
		requirements.
	If operator intervention can't be avoided, it must be possible to carry it out easily and in safety	Not applicable. No this kind of situation.
1.6.5	Cleaning of internal parts	-
	The machinery must be designed and constructed in such a way that it is possible to clean internal parts which have contained dangerous substances or preparations without entering them; any necessary unblocking must also be possible from the outside	Pass. The design of this machine is allowed to carry out this work.
	If it is absolutely impossible to avoid entering the machinery, the manufacturer must take steps during its construction to allow cleaning to take place with the minimum of danger	Not applicable. No this kind of situation.
1.7	Indicators	-
1.7.1	Information devices	-
	The information needed to control machinery must be unambiguous and easily understood	Pass. The information is identified clearly and can be easily under understood.
	It must not be excessive to the extent of overloading the operator	Pass.
	Where the health and safety of exposed persons may be endangered by a fault in the operation of unsupervised machinery, the machinery must be equipped to give an appropriate acoustic or light signal as a warning	Pass. An alarm light with buzzer has been used.
1.7.2	Warning devices	-
	Where machinery is equipped with warning devices, these must be unambiguous and easily perceived	Pass. The warning devices comply with ergonomic principles.
	The operator must have facilities to check the operation of such warning devices at all times	Pass. Such facilities are provided.
	The requirements of the specific directives concerning colors and safety signals must be complied with	Pass. These requirements are complied with.
1.7.3	Warning of residual risks	-
	Where risks remain despite all the measures adopted or in the case of potential risks which are not evident, the manufacturer must provide warnings	Not applicable. No any residual risk has been found.
	Such warnings should preferably use readily understandable pictograms and/or be drawn up in one of the languages of the country in which the machinery is to be used, accompanied, on request, by the languages understood by the operators	Not applicable.
1.7.4	Marking	-
	All machinery must be marked legibly and indelibly	-

Clause	Requirement - test	Verdict
	with the following minimum particular:	
	- name and address of the manufacturer	Pass. Name and address of the manufacturer has been marked in the nameplate.
	- CE mark, which includes the year of construction	Pass.
	- designation of series or type	Pass. Designation of series or type has been marked in the nameplate.
	- serial number, if any	Pass. Serial number has been marked in the nameplate.
	Furthermore, where the manufacturer constructs machinery intended for use in a potentially explosive atmosphere, this must be indicated on the machinery	Not applicable. This machine is not intended to be used in a potentially explosive atmosphere.
	Machinery must also bear full information relevant to its type and essential to its safe use	Pass. Such information is
	Where a machine part must be handled during use with lifting equipment, its mass must be indicated legible, indelibly and unambiguously	Not applicable.
	The interchangeable equipment referred to in Article 1(2), third subparagraph, must bear the same information	Pass. All the related information is provided legible, indelibly and unambiguously.
1.7.5	Instruction	-
	a) All machinery must be accompanied by instructions including at least the following :	-
	- a repeat of the information with which the machinery is marked, except the serial number, together with any appropriate additional information to facilitate maintenance	Pass. All related information have been provided within the instruction manual.
	- foreseen use of the machinery within the meaning of 1.1.2(c)	Pass. All related information have been provided within the instruction manual
	- workstation(s) likely to be occupied by operators	Pass. All related information have been provided within the instruction manual.
	- instructions for safe	Pass. All related information have been provided within the instruction manual.
	- putting into service	Pass. All related information have been provided within the instruction

Clause	Requirement - test	Verdict
		manual.
	- use	-
	- handling, giving the mass of the machinery and its various parts where they are regularly to be transported separately	Pass. All related information has been provided within the instruction manual.
	- installation	Pass. All related information has been provided within the instruction manual.
	- assembling, dismantling	Pass.
	- adjustment	Pass.
	- maintenance (servicing and repair)	Pass.
	- where necessary, training instructions	Pass.
	- where necessary, the essential characteristics of tools which may be fitted to the machinery	Pass.
	Where necessary, the instructions should draw attention to ways in which the machinery should not be used	Pass. All related information has been provided within the instruction manual.
	b) The instructions , must be drawn up in one of the Community languages by the manufacturer or his authorized representative established in the Community	Pass. Chinese and English versions of the instruction manual are provided.
	On being put into service, all machinery must be accompanied by a translation of the instructions in the language or languages of the country in which the machinery is to be used and by the instructions in the original language	Pass. English versions of the instruction manual are provided.
	This translation must be done either by the manufacturer or his authorized representative established in the Community or by the person introducing the machinery into the language area in question	Pass. The translation is done by the manufacture.
	By way of derogation from this requirement, the maintenance instructions for use by the specialized personnel employed by the manufacturer or his authorized representative established in the Community may be drawn up in only one of the Community languages understood by that personnel	Pass.
	c) The instructions must contain the drawing and diagrams necessary for putting into service, maintenance, inspection, checking of correct operation and, where appropriate, repair of the machinery and all useful instructions in particular with regard to safety	Pass. All related information has been provided within the instruction manual.
	d) Any literature describing the machinery must not	Pass.

Clause	Requirement - test	Verdict
	contradict the instructions as regards safety aspects	No such situation exists.
	The technical documentation describing the machinery must give information regarding the airborne noise emission referred to in(f) and, in the case of hand-help and/or hand-guided machinery, information regarding vibration as referred to in 2.2	Pass. All related information has been provided within the technical documentation.
	e) Where necessary, the instructions must give the requirement relating to installation and assembly for reducing noise or vibration	Not applicable.
	f) The instructions must give the following information- concerning airborne noise emission by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:	-
	- equivalent continuous A-weighted pressure level at workstations, where this exceeds 70 dB(A); where this level doesn't exceed 70dB(A),this fact must be indicated	Pass. The noise pressure level not exceeds 70dB.
	- peak C-weighted instantaneous sound pressure value at workstations, where this exceeds 63 Pa(130 dB in relation to 20 mPa)	Not applicable.
	- sound power level emitted by the machinery where the equivalent continuous A-weight sound pressure level at workstations exceeds 85 dB(A)	Not applicable. Not exceeds 85dB
	In the case of very large machinery, instead of the sound power level, the equivalent continuous sound pressure levels at specified positions around the machinery may be indicated	Pass. The sound pressure levels not exceed 70dB
	Where the harmonized standards are not applied sound levels must be measured using the most appropriate method for the machinery	Pass. Appropriate standards are applied to determine the sound level.
	The manufacturer must indicate the operating conditions of the machinery during measurement and what methods have been used for the measurement	Pass. All related information has been provided within the technical documentation.
	Where the workstation(s) are undefined or can't be defined, sound pressure levels must be measured at a distance of 1 meter from the surface of the machinery and at a height of 1.60 meters from the floor or access platform	Not applicable. The workstation has been defined.
	The position and value of the maximum sound pressure must be indicated	Pass. It has been indicated in the appropriate position of the machine.
	g) If the manufacturer foresees that the machinery will be used in a potentially explosive atmosphere, the instructions must give all the necessary information	Not applicable. This machine is not intended to be used in a potentially explosive

Clause	Requirement - test	Verdict
		atmosphere.
	h) In the case of machinery which may also be intended for use by non-professional operators, the wording and layout of the instructions for use, whilst respecting the other essential requirement mentioned above, must take into account the level of general education and acumen that can reasonably be expected from such operators	Pass. All these requirements have been taken into account.
2	Essential health and safety requirements for certain categories of machinery	-
2.1	Agri-foodstuffs machinery	-
	Where machinery is intended to prepare and process foodstuffs, it must be so designed and constructed as to avoid any risk of infection, sickness or contagion and the following hygiene rules must be observed:	Not applicable.
	a) materials in contact, or intended to come into contact, with the foodstuffs must satisfy the conditions set down in the relevant Directives	Not applicable.
	The machinery must be so designed and constructed that these materials can be clean before each use	Not applicable.
	b) all surfaces including their joinings must be so smooth, and must have neither ridges nor crevices which could harbor organic materials	Not applicable.
	c) assemblies must be designed in such a way as to reduce projections, edges and recesses to a minimum	Not applicable.
	They should preferably be made by welding or continuous bonding	Not applicable.
	Screws, screw heads and rivets may not be used except where technically unavoidable	Not applicable.
	d) all surfaces in contact with the foodstuffs must be easily cleaned and disinfected, where possible after removing easily dismantled parts	Not applicable.
	The inside surfaces must have curves of a radius sufficient to allow through cleaning	Not applicable.
	e) liquid deriving from foodstuffs as well as cleaning disinfecting and rinsing fluids should be able to be discharged from the machine without impediment	Not applicable.
	f) machinery must be so designed and constructed as to prevent any liquids or living creatures, in particular insects, entering, or any organic matter accumulating in area that can't be cleaned	Not applicable.
	g) machinery must be so designed and constructed that no ancillary substances can come into contact with foodstuffs	Not applicable.
	Where necessary, machinery must be designed and	Not applicable.

Clause	Requirement - test	Verdict
	constructed so that continuing compliance with this requirement can be checked	
	Instructions	Not applicable.
	In addition to the information required in Section1, the instructions must indicate recommended products and methods for cleaning, disinfecting and rinsing(not only for easily accessible areas but also where areas to which access is impossible or inadvisable, such as piping, have to be cleaned in it situ)	Not applicable.
2.2	Portable hand-help and/or hand-guided machinery	-
	Portable hand-help and/or hand-guided machinery must conform to the following essential health and safety requirements:	-
	- according to the type of machinery, it must have a supporting surface of sufficient size and have a sufficient number of handles and supports of an appropriate size and arranged to ensure the stability of the machinery under the operating conditions foreseen by the manufacturer	Not applicable.
	- except where technically impossible or where there is an independent control, in the case of handles which can't be released in complete safety, it must be fitted with start and stop controls arranged in such a way that the operator can operate them without releasing the handles	Not applicable.
	- it must be designed, constructed or equipped to eliminate the risks of accidental starting and/or continued operation after the operator has released the handles	Not applicable.
	Equivalent steps must be taken if the requirement is not technically feasible	Not applicable.
	- portable hand-help machinery must be designed and constructed to allow, where necessary, a visual check of the contact of the tool with the material being processed	Not applicable.
	Instructions	-
	The instructions must give the following information concerning vibrations transmitted by hand-help and hand-guided machinery	-
	- the weight root mean square value to which the arms are subjected, if it exceeds 2.5 m/s^2 as determined by the appropriate test code	Not applicable.
	Where the acceleration doesn't exceed 2.5 m/s^2 , this must be mentioned	Not applicable.
	If there is no applicable test code, the manufacturer must	Not applicable.

Clause	Requirement - test	Verdict
	indicate the measurement methods and conditions under which measurement were made	
2.3	Machinery for working wood and analogous materials	Not applicable
	Machinery for working wood and machinery for working materials with physical and technology characteristics similar to those of wood, such as cork, bone, hardened rubber, hardened plastic material and other similar stiff material must conform the following essential health and safety requirements	Not applicable.
	a) the machinery must be designed, constructed or equipped so that the piece being machined can be placed and guided in safety; where the piece is hand-help on a work-bench the latter must be sufficiently stable during the work and must not impede the movement of the piece	Not applicable.
	b) where the machinery is likely to be used in conditions involving the risk of ejection of pieces of wood, it must be designed, constructed or equipped to eliminate this ejection, or, if this is not the case, so that the ejection doesn't engender risks for the operator and/or exposed persons	Not applicable.
	c) the machinery must be equipped with an automatic brake that stops the tool in a sufficiently short time if there is a risk of contact with the tool whilst it runs down	Not applicable.
	d) where the tool is incorporated into a non-fully automated machine, the latter must be so designed and constructed as eliminate or reduce the risk of serious accidental injury	Not applicable.
3	Essential health and safety requirement to offset the particular hazards due to the mobility machinery	
4	Essential health and safety requirement to offset the particular hazards due to a lifting operation	
5	Essential health and safety requirement for machinery intended for underground work	
6	Essential health and safety requirement to offset the particular hazards due to the lifting or moving of persons	

TEST REPORT

EN ISO 12100:2010

Safety of machinery - general principles for design - risk assessment and risk reduction (EN ISO 12100:2010)

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Name and address of the Factory (production sites)	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China	
Product	Electric Scooter	
Model/type reference	ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G	
Rating and principal Characteristics	See the appended page	
Test Result	See Test Report	
Test report no.	XMT0201704830L/MD,XMT0201704831L/LVD,XMT0201704832L/EMC	
Work carried out by		Signature (签字盖章)
	G. Manager	
Work verified by	Peter	Signature
	Manager	
Date of issue	Feb.01,2018	



Clause	Requirement-Test	Result-Remark	Verdict
4	Strategy for risk assessment and risk reduction		-
	To implement risk assessment and risk reduction the designer shall take the following actions, in the order given (see Figure 1):	see Figure 1	P
	a) determine the limits of the machinery, which include the intended use and any reasonably foreseeable misuse thereof;		P
	b) identify the hazards and associated hazardous situations;		P
	c) estimate the risk for each identified hazard and hazardous situation;		P
	d) evaluate the risk and take decisions about the need for risk reduction;		P
	e) eliminate the hazard or reduce the risk associated with the hazard by means of protective measures.		P
	Actions a) to d) are related to risk assessment and e) to risk reduction.		P
	Risk assessment is a series of logical steps to enable, in a systematic way, the analysis and evaluation of the risks associated with machinery.		P
	Risk assessment is followed, whenever necessary, by risk reduction. Iteration of this process can be necessary to eliminate hazards as far as practicable and to adequately reduce risks by the implementation of protective measures.		P
	It is assumed that, when present on machinery, a hazard will sooner or later lead to harm if no protective measure or measures have been implemented. Examples of hazards are given in Annex B.		P
	Protective measures are the combination of the measures implemented by the designer and the user in accordance with Figure 2. Measures which can be incorporated at the design stage are preferable to those implemented by the user and usually prove more effective.		P
	The objective to be met is the greatest practicable risk reduction, taking into account the four below factors. The strategy defined in this clause is represented by the flowchart in Figure 1. The process itself is iterative and several successive applications can be necessary to reduce the risk, making the best use of available technology. In carrying out this process, it is necessary to take into account these four factors, in the following order of preference:		P
	– the safety of the machine during all the phases of its life cycle;		P
	– the ability of the machine to perform its function;		P
	– the usability of the machine;		P
	– the manufacturing, operational and dismantling costs of the machine.		P
5	Risk assessment		-
5.1	General		-
	Risk assessment comprises (see Figure 1)		-
	– risk analysis, comprising		-
	1) determination of the limits of the machinery (see 5.3)		-
	2) hazard identification (5.4 and Annex B), and		-
	3) risk estimation (see 5.5), and		-

Clause	Requirement-Test	Result-Remark	Verdict
	— risk evaluation (see 5.6).		-
	Risk analysis provides information required for the risk evaluation, which in turn allows judgments to be made about whether or not risk reduction is required.		P
	These judgments shall be supported by a qualitative or, where appropriate, quantitative estimate of the risk associated with the hazards present on the machinery.		P
	The risk assessment shall be documented according to Clause 7.		P
5.2	Information for risk assessment		-
	The information for risk assessment should include the following.		P
	a) Related to machinery description:		-
	1) user specifications;	See manual	P
	2) anticipated machinery specifications, including	See manual	P
	i) a description of the various phases of the whole life cycle of the machinery,	See manual	P
	ii) design drawings or other means of establishing the nature of the machinery, and		P
	iii) required energy sources and how they are supplied;	Pass Muster	P
	3) documentation on previous designs of similar machinery, if relevant;		P
	4) information for use of the machinery, as available.	See manual	P
	b) Related to regulations, standards and other applicable documents:		-
	1) applicable regulations;		P
	2) relevant standards;		P
	3) relevant technical specifications;		P
	4) relevant safety data sheets.		P
	c) Related to experience of use:		-
	1) any accident, incident or malfunction history of the actual or similar machinery;	Pass Muster	P
	2) the history of damage to health resulting, for example, from emissions (noise, vibration, dust, fumes, etc.), chemicals used or materials processed by the machinery;		P
	3) the experience of users of similar machines and, whenever practicable, an exchange of information with the potential users.		P
	d) Relevant ergonomic principles.		-
	The information shall be updated as the design develops or when modifications to the machine are required.		P
	Comparisons between similar hazardous situations associated with different types of machinery are often possible, provided that sufficient information about hazards and accident circumstances in those situations is available.	Pass Muster	P
	For quantitative analysis, data from databases, handbooks, laboratories or manufacturers' specifications may be used, provided that there is confidence in the suitability of the data. Uncertainty associated with these data shall be indicated in the documentation (see Clause 7).	see Clause 7	P
5.3	Determination of limits of machinery		P
5.3.1	General		-

Clause	Requirement-Test	Result-Remark	Verdict
	Risk assessment begins with the determination of the limits of the machinery, taking into account all the phases of the machinery life. This means that the characteristics and performances of the machine or a series of machines in an integrated process, and the related people, environment and products, should be identified in terms of the limits of machinery as given in 5.3.2 to 5.3.5.	Pass Muster	P
5.3.2	Use limits		-
	Use limits include the intended use and the reasonably foreseeable misuse. Aspects to be taken into account include the following:		-
	a) the different machine operating modes and different intervention procedures for the users, including interventions required by malfunctions of the machine;	Pass Muster	P
	b) the use of the machinery (for example, industrial, non-industrial and domestic) by persons identified by sex, age, dominant hand usage, or limiting physical abilities (visual or hearing impairment, size, strength, etc.);		P
	c) the anticipated levels of training, experience or ability of users including		-
	1) operators,		P
	2) maintenance personnel or technicians,		P
	3) trainees and apprentices, and		P
	4) the general public;		P
	d) exposure of other persons to the hazards associated with the machinery where it can be reasonably foreseen:		-
	1) persons likely to have a good awareness of the specific hazards, such as operators of adjacent machinery;		P
	2) persons with little awareness of the specific hazards but likely to have a good awareness of site safety procedures, authorized routes, etc., such as administration staff;		P
	3) persons likely to have very little awareness of the machine hazards or the site safety procedures, such as visitors or members of the general public, including children.		P
	If specific information is not available in relation to b), above, the manufacturer should take into account general information on the intended user population (for example, appropriate anthropometric data).	Not Applicable	N/A
5.3.3	Space limits		-
	Aspects of space limits to be taken into account include		-
	a) the range of movement,		P
	b) space requirements for persons interacting with the machine, such as during operation and maintenance,		P
	c) human interaction such as the operator-machine interface, and		P
	d) the machine-power supply interface.		P
5.3.4	Time limits		-
	Aspects of time limits to be taken into account include		-
	a) the life limit of the machinery and/or of some of its components (tooling, parts that can wear, electromechanical components, etc.), taking into account its intended use and reasonably foreseeable misuse		P
	b) recommended service intervals.		-
5.3.5	Other limits		-

Clause	Requirement-Test	Result-Remark	Verdict
	Examples of other limits include	Not Applicable	N/A
	a) properties of the material(s) to be processed,		N/A
	b) housekeeping — the level of cleanliness required, and		N/A
	c) environmental — the recommended minimum and maximum temperatures, whether the machine can be operated indoors or outdoors, in dry or wet weather, in direct sunlight, tolerance to dust and wet, etc.		N/A
5.4	Hazard identification		-
	After determination of the limits of the machinery, the essential step in any risk assessment of the machinery is the systematic identification of reasonably foreseeable hazards (permanent hazards and those which can appear unexpectedly), hazardous situations and/or hazardous events during all phases of the machine life cycle, i.e.:	Pass Muster	P
	— transport, assembly and installation;		P
	— commissioning;		P
	— use;		P
	— dismantling, disabling and scrapping.		P
	Only when hazards have been identified can steps be taken to eliminate them or to reduce risks. To accomplish this hazard identification, it is necessary to identify the operations to be performed by the machinery and the tasks to be performed by persons who interact with it, taking into account the different parts, mechanisms or functions of the machine, the materials to be processed, if any, and the environment in which the machine can be used.	Comply with the requirement	P
	The designer shall identify hazards taking into account the following.		-
	a) Human interaction during the whole life cycle of the machine		-
	Task identification should consider all tasks associated with every phase of the machine life cycle as given above. Task identification should also take into account, but not be limited to, the following task categories:		P
	<ul style="list-style-type: none"> — setting; — testing; — teaching/programming; — process/tool changeover; — start-up; — all modes of operation; — feeding the machine; — removal of product from machine; — stopping the machine; — stopping the machine in case of emergency; — recovery of operation from jam or blockage; — restart after unscheduled stop; — fault-finding/trouble-shooting (operator intervention); — cleaning and housekeeping; — preventive maintenance; — corrective maintenance. 		P

Clause	Requirement-Test	Result-Remark	Verdict
	All reasonably foreseeable hazards, hazardous situations or hazardous events associated with the various tasks shall then be identified. Annex B gives examples of hazards, hazardous situations and hazardous events to assist in this process. Several methods are available for the systematic identification of hazards. See also ISO/TR 14121-2.	See also ISO/TR 14121-2	P
	In addition, reasonably foreseeable hazards, hazardous situations or hazardous events not directly related to tasks shall be identified.	Pass Muster	P
	b) Possible states of the machine		-
	These are as follows:		-
	1) the machine performs the intended function (the machine operates normally);		P
	2) the machine does not perform the intended function (i.e. it malfunctions) due to a variety of reasons, including		-
	<ul style="list-style-type: none"> – variation of a property or of a dimension of the processed material or of the workpiece, – failure of one or more of its component parts or services, – external disturbances (for example, shocks, vibration, electromagnetic interference), – design error or deficiency (for example, software errors), – disturbance of its power supply, and – surrounding conditions (for example, damaged floor surfaces). 		P
	c) Unintended behaviour of the operator or reasonably foreseeable misuse of the machine		-
	<ul style="list-style-type: none"> – loss of control of the machine by the operator (especially for hand-held or mobile machines), – reflex behaviour of a person in case of malfunction, incident or failure during the use of the machine, – behaviour resulting from lack of concentration or carelessness, – behaviour resulting from taking the “line of least resistance” in carrying out a task, – behaviour resulting from pressures to keep the machine running in all circumstances, and – behaviour of certain persons (for example, children, disabled persons). 		P
5.5	Risk estimation		-
5.5.1	General		-
	After hazard identification, risk estimation shall be carried out for each hazardous situation by determining the elements of risk given in 5.5.2. When determining these elements, it is necessary to take into account the aspects given in 5.5.3.		P
	If standardized (or other suitable) measurement methods exist for an emission, they should be used, in conjunction with existing machinery or prototypes, to determine emission values and comparative emission data. This makes it possible for the designer to		-
	– estimate the risk associated with the emissions,		P
	– evaluate the effectiveness of the protective measures implemented at the design stage,		P
	– provide potential buyers with quantitative information on emissions in the technical documentation, and		P

Clause	Requirement-Test	Result-Remark	Verdict
	— provide users with quantitative information on emissions in the information for use.		P
	Hazards other than emissions that are described by measurable parameters can be dealt with in a similar manner.		P
5.5.2	Elements of risk		-
5.5.2.1	General		-
	The risk associated with a particular hazardous situation depends on the following elements:		-
	a) the severity of harm;		P
	b) the probability of occurrence of that harm, which is a function of		P
	1) the exposure of person(s) to the hazard,		P
	2) the occurrence of a hazardous event, and		P
	3) the technical and human possibilities to avoid or limit the harm.		P
	The elements of risk are shown in Figure 3. Additional details are given in 5.5.2.2, 5.5.2.3 and 5.5.3.	See Figure 3	P
5.5.2.2	Severity of harm		-
	The severity can be estimated by taking into account the following:		-
	a) the severity of injuries or damage to health, for example,		-
	— slight, — serious, — death.	Slight	P
	b) the extent of harm, for example, to		-
	— one person, — several persons.	One person	P
	When carrying out a risk assessment, the risk from the most likely severity of the harm that is likely to occur from each identified hazard shall be considered, but the highest foreseeable severity shall also be taken into account, even if the probability of such an occurrence is not high.	Pass Muster	P
5.5.2.3	Probability of occurrence of harm		-
5.5.2.3.1	Exposure of persons to the hazard		-
	The exposure of a person to the hazard influences the probability of the occurrence of harm. Factors to be taken into account when estimating the exposure are, among others,		P
	a) the need for access to the hazard zone (for normal operation, correction of malfunction, maintenance or repair, etc.)		P
	b) the nature of access (for example, manual feeding of materials),		P
	c) the time spent in the hazard zone,		P
	d) the number of persons requiring access, and		P
	e) the frequency of access.		P
5.5.2.3.2	Occurrence of a hazardous event		-
	The occurrence of a hazardous event influences the probability of occurrence of harm. Factors to be taken into account when estimating the occurrence of a hazardous event are, among others,		-
	a) reliability and other statistical data,		P

Clause	Requirement-Test	Result-Remark	Verdict
	b) accident history,		P
	c) history of damage to health, and		P
	d) comparison of risks (see 5.6.3).		P
5.5.2.3.3	Possibility of avoiding or limiting harm		-
	The possibility of avoiding or limiting harm influences the probability of occurrence of harm. Factors to be taken into account when estimating the possibility of avoiding or limiting harm are, among others, the following:		P
	a) different persons who can be exposed to the hazard(s), for example,		-
	– skilled, – unskilled;	Skilled	P
	b) how quickly the hazardous situation could lead to harm, for example,		-
	– suddenly, – quickly, – slowly;	Quickly	P
	c) any awareness of risk, for example,		-
	– by general information, in particular, information for use, – by direct observation, – through warning signs and indicating devices, in particular, on the machinery;	Through warning signs and indicating devices, in particular, on the machinery;	P
	d) the human ability to avoid or limit harm (for example, reflex, agility, possibility of escape);	Reflex	P
	e) practical experience and knowledge, for example,		-
	– of the machinery, – of similar machinery, – no experience.	practical experience and knowledge of the machinery	P
5.5.3	Aspects to be considered during risk estimation		-
5.5.3.1	Persons exposed		-
	Risk estimation shall take into account all persons (operators and others) for whom exposure to the hazard is reasonably foreseeable.	Pass Muster	P
5.5.3.2	Type, frequency and duration of exposure		-
	The estimation of the exposure to the hazard under consideration (including long-term damage to health) requires analysis of, and shall account for, all modes of operation of the machinery and methods of working. In particular, the analysis shall account for the needs for access during loading/unloading, setting, teaching, process changeover or correction, cleaning, fault-finding and maintenance.		P
	The risk estimation shall also take into account tasks, for which it is necessary to suspend protective measures.		P
5.5.3.3	Relationship between exposure and effects		-
	The relationship between an exposure to a hazard and its effects shall be taken into account for each hazardous situation considered. The effects of accumulated exposure and combinations of hazards shall also be considered. When considering these effects, risk estimation shall, as far as practicable, be based on appropriate recognized data.		P

Clause	Requirement-Test	Result-Remark	Verdict
5.5.3.4	Human factors		-
	Human factors can affect risk and shall be taken into account in the risk estimation, including, for example,		-
	a) the interaction of person(s) with the machinery, including correction of malfunction, b) interaction between persons, c) stress-related aspects, d) ergonomic aspects, e) the capacity of persons to be aware of risks in a given situation depending on their training, experience and ability, f) fatigue aspects, and g) aspects of limited abilities (due to disability, age, etc.).		P
	Training, experience and ability can affect risk; nevertheless, none of these factors shall be used as a substitute for hazard elimination, risk reduction by inherently safe design measure or safeguarding, wherever these protective measures can be practicably implemented.		P
5.5.3.5	Suitability of protective measures		-
	Risk estimation shall take into account the suitability of protective measures and shall		P
	a) identify the circumstances which can result in harm,		P
	b) whenever appropriate, be carried out using quantitative methods to compare alternative protective measures (see ISO/TR 14121-2), and		P
	c) provide information that can assist with the selection of appropriate protective measures.	Provided	P
	When estimating risk, those components and systems identified as immediately increasing the risk in case of failure need special attention.		P
	When protective measures include work organization, correct behaviour, attention, application of personal protective equipment (PPE), skill or training, the relatively low reliability of such measures compared with proven technical protective measures shall be taken into account in the risk estimation.		P
5.5.3.6	Possibility of defeating or circumventing protective measures		-
	For the continued safe operation of a machine, it is important that the protective measures allow its easy use and do not hinder its intended use. Otherwise, there is a possibility that protective measures might be bypassed in order for maximum utility of the machine to be achieved.		P
	Risk estimation shall take account of the possibility of defeating or circumventing protective measures. It shall also take account of the incentive to defeat or circumvent protective measures when, for example,		P
	a) the protective measure slows down production or interferes with another activity or preference of the user, b) the protective measure is difficult to use, c) persons other than the operator are involved, or d) the protective measure is not recognized by the user or not accepted as being suitable for its function.		P
	Whether or not a protective measure can be defeated depends on both the type of protective measure, such as an adjustable guard or programmable trip device, and its design details.		P
	Protective measures that use programmable electronic systems introduce additional possibilities of defeat or	Comply with the requirement	P

Clause	Requirement-Test	Result-Remark	Verdict
	circumvention if access to safety-related software is not appropriately restricted by design and monitoring methods. Risk estimation shall identify where safety-related functions are not separated from other machine functions and shall determine the extent to which access is possible. This is particularly important when remote access for diagnostic or process correction purposes is required.		
5.5.3.7	Ability to maintain protective measures		-
	Risk estimation shall consider whether the protective measures can be maintained in the condition necessary to provide the required level of protection.		P
5.5.3.8	Information for use		-
	Risk estimation shall take into account the information for use, as available.	See also 6.4	P
5.6	Risk evaluation		-
5.6.1	General		-
	After risk estimation has been completed, risk evaluation shall be carried out to determine if risk reduction is required. If risk reduction is required, then appropriate protective measures shall be selected and applied (see Clause 6). As shown in Figure 1, the adequacy of the risk reduction shall be determined after applying each of the three steps of risk reduction described in Clause 6. As part of this iterative process, the designer shall also check whether additional hazards are introduced or other risks increased when new protective measures are applied. If additional hazards do occur, they shall be added to the list of identified hazards and appropriate protective measures will be required to address them.		P
	Achieving the objectives of risk reduction and a favourable outcome of risk comparison applied when practicable gives confidence that risk has been adequately reduced.		P
5.6.2	Adequate risk reduction		-
	Application of the three-step method described in 6.1 is essential in achieving adequate risk reduction.		P
	Following the application of the three-step method, adequate risk reduction is achieved when		P
	— all operating conditions and all intervention procedures have been considered,		P
	— the hazards have been eliminated or risks reduced to the lowest practicable level,		P
	— any new hazards introduced by the protective measures have been properly addressed,		P
	— users are sufficiently informed and warned about the residual risks (see 6.1, step 3),		P
	— protective measures are compatible with one another,		P
	— sufficient consideration has been given to the consequences that can arise from the use in a nonprofessional/ non-industrial context of a machine designed for professional/industrial use, and		
	— the protective measures do not adversely affect the operator's working conditions or the usability of the machine.		P
5.6.3	Comparison of risks		-
	As part of the process of risk evaluation, the risks associated with the machinery or parts of machinery can	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	be compared with those of similar machinery or parts of machinery, provided the following criteria apply:		
	— the similar machinery is in accordance with the relevant type-C standard(s);		P
	— the intended use, reasonably foreseeable misuse and the way both machines are designed and constructed are comparable;		P
	— the hazards and the elements of risk are comparable;		P
	— the technical specifications are comparable;		P
	— the conditions for use are comparable.		P
	The use of this comparison method does not eliminate the need to follow the risk assessment process as described in this International Standard for the specific conditions of use. For example, when a band saw used for cutting meat is compared with a band saw used for cutting wood, the risks associated with the different material shall be assessed.	Pass Muster	P
6	Risk reduction		-
6.1	General		-
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk:		P
	— severity of harm from the hazard under consideration;		P
	— probability of occurrence of that harm.		P
	All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2).	See also Figures 1 and 2	P
	Step 1: Inherently safe design measures		-
	Inherently safe design measures eliminate hazards or reduce the associated risks by a suitable choice of design features of the machine itself and/or interaction between the exposed persons and the machine. See 6.2.	Pass Muster	P
	Step 2: Safeguarding and/or complementary protective measures		-
	Taking into account the intended use and the reasonably foreseeable misuse, appropriately selected safeguarding and complementary protective measures can be used to reduce risk when it is not practicable to eliminate a hazard, or reduce its associated risk sufficiently, using inherently safe design measures. See 6.3.	Pass Muster	P
	Step 3: Information for use		-
	Where risks remain despite inherently safe design measures, safeguarding and the adoption of complementary protective measures, the residual risks shall be identified in the information for use. The information for use shall include, but not be limited to, the following:		P
	— operating procedures for the use of the machinery consistent with the expected ability of personnel who use the machinery or other persons who can be exposed to the hazards associated with the machinery;		P
	— the recommended safe working practices for the use of the machinery and the related training requirements adequately described;		P
	— sufficient information, including warning of residual		P

Clause	Requirement-Test	Result-Remark	Verdict
	risks for the different phases of the life of the machinery;		
	— the description of any recommended personal protective equipment, including detail as to its need as well as to training needed for its use.		P
	Information for use shall not be a substitute for the correct application of inherently safe design measures, safeguarding or complementary protective measures.		P
6.2	Inherently safe design measures		-
6.2.1	General		-
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed.		P
	Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.		P
6.2.2	Consideration of geometrical factors and physical aspects		-
6.2.2.1	Geometrical factors		-
	Such factors include the following.		-
	a) The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position — reducing blind spots, for example — and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example:	Pass Muster	P
	— the travelling and working area of mobile machines;		P
	— the zone of movement of lifted loads or of the carrier of machinery for lifting persons;		P
	— the area of contact of the tool of a hand-held or hand-guided machine with the material being worked.		P
	The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.		P
	b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazards are avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857).		P
	c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can "trap" parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a "trap" shall be capped.	Pass Muster	P
	d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).		P

Clause	Requirement-Test	Result-Remark	Verdict
6.2.2.2	Physical aspects		-
	Such aspects include the following:		-
	a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard;		P
	b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy;		P
	c) limiting the emissions by acting on the characteristics of the source using measures for reducing		P
	1) noise emission at source (see ISO/TR 11688-1),		P
	2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for hand-held and hand-guided machinery, see CR 1030-1)],		P
	3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding),		P
	4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN 12198-3)].	Pass Muster	P
6.2.3	Taking into account general technical knowledge of machine design		-
	This general technical knowledge can be derived from technical specifications for design (standards, design codes, calculation rules, etc.), which should be used to cover		P
	a) mechanical stresses such as		-
	— stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies, — stress limitation by overload prevention (bursting disk, pressure-limiting valves, breakage points, torque-limiting devices, etc.), — avoiding fatigue in elements under variable stresses (notably cyclic stresses), and — static and dynamic balancing of rotating elements,	The appropriate technical knowledge of mechanical has been taken into account.	P
	b) materials and their properties such as		-
	— resistance to corrosion, ageing, abrasion and wear, — hardness, ductility, brittleness, — homogeneity, — toxicity, and — flammability, and	The materials have been treated by appropriate methods.	P
	c) emission values for		-
	— noise, — vibration,		P

Clause	Requirement-Test	Result-Remark	Verdict
	<ul style="list-style-type: none"> — hazardous substances, and — radiation. 		
	When the reliability of particular components or assemblies is critical for safety (for example, ropes, chains, lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate working coefficients.	Appropriate working coefficients have been taken into account during design and calculation.	P
6.2.4	Choice of appropriate technology		-
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certain applications such as the following:		-
	a) on machines intended for use in explosive atmospheres, using		N/A
	<ul style="list-style-type: none"> — appropriately selected pneumatic or hydraulic control system and machine actuators, — intrinsically safe electrical equipment (see IEC 60079-11); 		N/A
	b) for particular products to be processed (for example, by a solvent), by using equipment that ensures the temperature will remain far below the flash point;		N/A
	c) the use of alternative equipment to avoid high noise levels, such as		P
	<ul style="list-style-type: none"> — electrical instead of pneumatic equipment, — in certain conditions, water-cutting instead of mechanical equipment. 	The appropriate technology has been chosen.	P
6.2.5	Applying principle of positive mechanical action		-
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).	The principle of the positive mechanical action of a component on another component has been applied.	P
6.2.6	Provisions for stability		-
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include	These machines have been designed to have sufficient stability to allow them to be used safely in their specified conditions of use.	P
	<ul style="list-style-type: none"> — the geometry of the base, — the weight distribution, including loading, — the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the machine which can result in an overturning moment, — vibration, — oscillations of the centre of gravity, — characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.), and — external forces, such as wind pressure and manual forces. 	These factors have been taken into account during design.	P
	Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping.		P

Clause	Requirement-Test	Result-Remark	Verdict
	Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.		P
6.2.7	Provisions for maintainability		-
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine:		-
	<ul style="list-style-type: none"> — accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used; — ease of handling, taking into account human capabilities; — limitation of the number of special tools and equipment. 	These factors have been taken into account during design.	P
6.2.8	Observing ergonomic principles		-
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design.	Appropriate ergonomic principles have been taken into account in designing machinery to reduce mental or physical stress and strain of the operator.	P
	Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2).		P
	All elements of the operator-machine interface, such as controls, signalling or data display elements, shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN 614-1, EN 13861 and IEC 61310-1.	All arrangement and design of manual controls have been checked in compliance with.	P
	The designer's attention is particularly drawn to following ergonomic aspects of machine design.		P
	a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators).	Stressful postures and movements during use of the machine have been avoided.	P
	b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand, arm and leg anatomy.	This machine has been adjusted to the human strength and convenient movement.	P
	c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures.		P
	d) Avoid linking the operator's working rhythm to an automatic succession of cycles.		P
	e) Provide local lighting on or in the machine for the illumination of the working area and of adjusting, setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling, shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be	Adequate lighting is provided.	P

Clause	Requirement-Test	Result-Remark	Verdict
	adjusted, its location shall be such that it does not cause any risk to persons making the adjustment.		
	f) Select, locate and identify manual controls (actuators) so that		-
	<ul style="list-style-type: none"> – they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4), – they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation), – their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and – their operation cannot cause additional risk. 	All design and arrangement of the control logic have been checked in compliance with this requirement.	P
	See also ISO 9355-3.		P
	Where a control is designed and constructed to perform several different actions — namely, where there is no one-to-one correspondence (for example, keyboards) — the action to be performed shall be clearly displayed and subject to confirmation where necessary.		N/A
	Controls shall be so arranged that their layout, travel and resistance to operation are compatible with the action to be performed, taking account of ergonomic principles. Constraints due to the necessary or foreseeable use of personal protective equipment (such as footwear, gloves) shall be taken into account.		N/A
	g) Select, design and locate indicators, dials and visual display units so that		N/A
	<ul style="list-style-type: none"> – they fit within the parameters and characteristics of human perception, – information displayed can be detected, identified and interpreted conveniently, i.e. long-lasting, distinct, unambiguous and understandable with respect to the operator's requirements and the intended use, and – the operator is able to perceive them from the control position. 		N/A
6.2.9	Electrical hazards		-
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).	Pass Muster	P
6.2.10	Pneumatic and hydraulic hazards		-
	Pneumatic and hydraulic equipment of machinery shall be designed so that		-
	<ul style="list-style-type: none"> – the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices), 	Appropriate limiting devices have been provided.	P
	<ul style="list-style-type: none"> – no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum, 		N/A
	<ul style="list-style-type: none"> – no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures, 		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	— air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements,	The pipes have been protected by appropriated devices.	P
	— all elements of the equipment, especially pipes and hoses, are protected against harmful external effects,	The pipes have been protected by appropriated devices.	P
	— as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, Clause 5)		P
	— all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.	This requirement is complied with by appropriate design.	P
6.2.11	Applying inherently safe design measures to control systems		-
6.2.11.1	General		-
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061).	Inherently safe design measures to control system have applied.	P
	The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behaviour.		P
	Typical causes of hazardous machine behaviour are		-
	— an unsuitable design or modification (accidental or deliberate) of the control system logic, — a temporary or permanent defect or failure of one or several components of the control system, — a variation or a failure in the power supply of the control system, and — inappropriate selection, design and location of the control devices.	No this kind of hazard in this machine	P
	Typical examples of hazardous machine behaviour are		-
	— unexpected start-up (see ISO 14118), — uncontrolled speed change, — failure to stop moving parts, — dropping or ejection of part of the machine or of a workpiece clamped by the machine, and — machine action resulting from inhibition (defeating or failure) of protective devices.	No this kind of hazard in this machine	P
	In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1, IEC 60204-1 and IEC 62061).	the design of control systems comply with the related principles and methods	P
	Control systems shall be designed to enable the operator to interact with the machine safely and easily. This requires one or several of the following solutions:		-

Clause	Requirement-Test	Result-Remark	Verdict
	— systematic analysis of start and stop conditions;		P
	— provision for specific operating modes (for example, start-up after normal stop, restart after cycle interruption or after emergency stop, removal of the workpieces contained in the machine, operation of a part of the machine in case of a failure of a machine element);	Enough provisions have been provided.	P
	— clear display of the faults;		P
	— measures to prevent accidental generation of unexpected start commands (for example, shrouded start device) likely to cause dangerous machine behaviour (see ISO 14118:2000, Figure 1);		P
	— maintained stop commands (for example, interlock) to prevent restarting that could result in dangerous machine behaviour (see ISO 14118:2000, Figure 1).		P
	An assembly of machines may be divided into several zones for emergency stopping, for stopping as a result of protective devices and/or for isolation and energy dissipation. The different zones shall be clearly defined and it shall be obvious which parts of the machine belong to which zone. Likewise, it shall be obvious which control devices (for example, emergency stop devices, supply disconnecting devices) and/or protective devices belong to which zone. The interfaces between zones shall be designed such that no function in one zone creates hazards in another zone which has been stopped for an intervention.		N/A
	Control systems shall be designed to limit the movements of parts of the machinery, the machine itself, or workpieces and/or loads held by the machinery, to the safe design parameters (for example, range, speed, acceleration, deceleration, load capacity). Allowance shall be made for dynamic effects (swinging of loads, etc.).		N/A
	For example:		-
	— the travelling speed of mobile pedestrian controlled machinery other than remote-controlled shall be compatible with walking speed;		N/A
	— the range, speed, acceleration and deceleration of movements of the person-carrier and carrying vehicle for lifting persons shall be limited to non-hazardous values, taking into account the total reaction time of the operator and the machine;		N/A
	— the range of movements of parts of machinery for lifting loads shall be kept within specified limits.		N/A
	When the machinery contains various elements that can be operated independently, the control system shall be designed to prevent risks arising out of a lack of coordination (for example, collision prevention system).		N/A
6.2.11.2	Starting of an internal power source/switching on an external power supply		-
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation.		P
	For example:		-
	— starting the internal combustion engine shall not lead to movement of a mobile machine;		P
	— connection to mains electricity supply shall not result in		P

Clause	Requirement-Test	Result-Remark	Verdict
	the starting of working parts of a machine.		
	See IEC 60204-1:2005, 7.5 (see also Annexes A and B).		P
6.2.11.3	Starting/stopping of a mechanism		-
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 0 to state 1 (where state 1 represents the highest energy state).		P
	The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 1 to state 0 (where state 1 represents the highest energy state).	The type of stopping of this machine belongs to state 1 and state 0.	P
	In certain applications, such as high-voltage switchgear, this principle cannot be followed, in which case other measures should be applied to achieve the same level of confidence for the stopping or slowing down.		P
	When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system.	No such situation exists.	P
6.2.11.4	Restart after power interruption		-
	If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve).	The spontaneous restart of a machine when it is re-energized after power interruption has been prevented by contactor.	P
6.2.11.5	Interruption of power supply		
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met:	The hazardous situations resulting from interruption or excessive fluctuation of the power supply has been prevented.	P
	— the stopping function of the machinery shall remain;		P
	— all devices whose permanent operation is required for safety shall operate in an effective way to maintain safety (for example, locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery);		P
	— parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.	No such situation exists.	P
6.2.11.6	Use of automatic monitoring		-
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such	Appropriate automatic monitoring has been used.	P

Clause	Requirement-Test	Result-Remark	Verdict
	that hazards are generated.		
	Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (for example, the beginning of the machine cycle).		P
	The protective measure may be, for example,		-
	– the stopping of the hazardous process,	Emergency stop is provided.	P
	– preventing the restart of this process after the first stop following the failure, or	Reset before restart is necessary.	P
	– the triggering of an alarm.	An alarm is provided.	P
6.2.11.7	Safety functions implemented by programmable electronic control systems		-
6.2.11.7.1	General		-
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behaviour on detection of a fault shall be considered (see also the IEC 61508 series for further guidance).	Such equipment is provided.	P
	The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.	All parts interact correctly to perform the safety function and that unintended functions do not occur.	P
6.2.11.7.2	Hardware aspects		-
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of	The hardware has been selected and installed to meet both the functional and performance requirements of the safety functions to be performed.	P
	– architectural constraints (the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault, etc.),		P
	– selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and		P
	– the incorporation of measures and techniques within the hardware so as to avoid systematic failures and	Appropriate devices are provided.	P

Clause	Requirement-Test	Result-Remark	Verdict
	control systematic faults.		
6.2.11.7.3	Software aspects		-
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3).	This requirement has been taken into account during designing the software.	P
	Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)].	Application software could not be re-programmable by the user.	P
	When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).	Passwords for the authorized persons have been used.	P
6.2.11.8	Principles relating to manual control		-
	These are as follows.		-
	a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f).	Manual control devices have been designed and located according to the relevant ergonomic principles given in 6.2.8,	P
	b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released.	A stop control device has been placed near each start control device.	P
	c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant.	Manual controls have been located out of reach of the danger zones.	P
	d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone.	The control devices and control positions have been located so that the operator is able to observe the working area or hazard zone.	P
	1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions. 2) On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements.		N/A
	e) If it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	portable control unit (such as a teach pendant), with which the operator can enter danger zones.		
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1, ISO 9355-3 and ISO 447).	Control actuators have been designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation.	P
	g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices).	Pass Muster	P
	h) For cableless control, an automatic stop shall be performed when correct control signals are not received, including loss of communication (see IEC 60204-1).		N/A
6.2.11.9	Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance		-
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously		N/A
	a) disables all other control modes,		N/A
	b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold-to-run control device,		N/A
	c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed, reduced power/force, step-by-step, for example, with a limited movement control device), and		N/A
	d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N/A
	This control mode shall be associated with one or more of the following measures:		-
	— restriction of access to the danger zone as far as possible;		N/A
	— emergency stop control within immediate reach of the operator;		N/A
	— portable control unit (teach pendant) and/or local controls (allowing sight of the controlled elements). See IEC 60204-1.		N/A
6.2.11.10	Selection of control and operating modes		-
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.		N/A
	The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example,		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	access codes for certain numerically controlled functions).		
6.2.11.11	Applying measures to achieve electromagnetic compatibility (EMC)		-
	For guidance on electromagnetic compatibility, see IEC 60204-1 and IEC 61000-6.		P
6.2.11.12	Provision of diagnostic systems to aid fault-finding		-
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure.	Diagnostic systems are provided	P
6.2.12	Minimizing probability of failure of safety functions		-
6.2.12.1	General		-
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine.		P
	The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.		P
6.2.12.2	Use of reliable components		-
	"Reliable components" means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2.13).	Reliable components have been used.	P
6.2.12.3	Use of "oriented failure mode" components		-
	"Oriented failure mode" components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted.		N/A
	The use of such components should always be considered, particularly in cases where redundancy (see 6.2.12.4) is not employed.		N/A
6.2.12.4	Duplication (or redundancy) of components or subsystems		-
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s), thereby ensuring that the safety function remains available.		N/A
	In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components.		N/A
	Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.		N/A
6.2.13	Limiting exposure to hazards through reliability of equipment		-
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring intervention, thereby reducing exposure to hazards.		P
	This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	as well as to other functions of machinery.		
	Safety-related components (for example, certain sensors) of known reliability shall be used.	Safety-critical components are used in this machine.	P
	The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.	Pass Muster	P
6.2.14	Limiting exposure to hazards through mechanization or automation of loading (feeding)/unloading (removal) operations		-
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations — of workpieces, materials or substances — limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points.	Pass Muster	P
	Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables.		P
	While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing, between the devices and parts of the machine or workpieces/materials being processed. Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.	Appropriate provisions have been provided.	P
	Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.	This requirement has been complied with by design.	P
6.2.15	Limiting exposure to hazards through location of setting and maintenance points outside danger zones		-
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.	Pass Muster	P
6.3	Safeguarding and complementary protective measures		-
6.3.1	General		-
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented.	Pass Muster	P
	Certain safeguards may be used to avoid exposure to more than one hazard.		P
6.3.2	Selection and implementation of guards and protective devices		-
6.3.2.1	General		-
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	hazards generated by moving parts, according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s).		
	The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine.		P
	In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery.		P
	As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment).	Movable interlocking guard is used.	P
	A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard.		N/A
	Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including	This requirement has been taken in to consideration.	P
	a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure (FOPS),	No such hazards exist in this machine.	P
	b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.),	No such hazards exist in this machine.	P
	c) hazards due to the environment (protection against heat, cold, foul weather, etc.),	No such hazards exist in this machine.	P
	d) hazards due to tipping over or rolling over of machinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS).	No such hazards exist in this machine.	P
	The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.	Ergonomic principles have been taken into account during design.	P
6.3.2.2	Where access to the hazard zone is not required during normal operation		-
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following:		-
	a) fixed guards (see also ISO 14120);	Fixed guards are provided.	p
	b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 14119 and ISO 14120);	Interlocking guards are provided.	N/A
	c) self-closing guards (see ISO 14120:2002, 3.3.2);		N/A
	d) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496) or pressure-		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	sensitive protective devices (see ISO 13856).		
6.3.2.3	Where access to the hazard zone is required during normal operation		-
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following:		-
	a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document);		N/A
	b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496);		N/A
	c) adjustable guards;		N/A
	d) self-closing guards (see ISO 14120:2002, 3.3.2);		N/A
	e) two-hand control devices (see ISO 13851);		N/A
	f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).		N/A
6.3.2.4	Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance		-
	As far as possible, machines shall be designed so that the safeguards provided for the protection of the production operator also ensure the protection of personnel carrying out setting, teaching, process changeover, fault-finding, cleaning or maintenance, without hindering them in the performance of their task. Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2).		N/A
6.3.2.5	Selection and implementation of sensitive protective equipment		-
6.3.2.5.1	Selection		-
	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are intended to provide the designer with criteria for selecting, for each application, the most suitable device(s).		N/A
	Types of sensitive protective equipment include		-
	<ul style="list-style-type: none"> — light curtains, — scanning devices, for example, laser scanners, — pressure-sensitive mats, and — trip bars, trip wires. 		N/A
	Sensitive protective equipment can be used		-
	<ul style="list-style-type: none"> — for tripping purposes, — for presence sensing, — for both tripping and presence sensing, or — to re-initiate machine operation — a practice subject to stringent conditions. 		N/A
	The following characteristics of the machinery, among others, can preclude the sole use of sensitive protective equipment:		N/A
	<ul style="list-style-type: none"> — tendency for the machinery to eject materials or component parts; — necessity to guard against emissions (noise, radiation, dust, etc.); — erratic or excessive machine stopping time; — inability of a machine to stop part-way through a cycle. 		N/A

Clause	Requirement-Test	Result-Remark	Verdict
6.3.2.5.2	Implementation		-
	Consideration should be given to		-
	a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment),		N/A
	b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment),		N/A
	c) the possibility of circumvention, and		-
	d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air).		N/A
	Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that		N/A
	— a command is given as soon as a person or part of a person is detected,		N/A
	— the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment is maintained by the control system until a new command is given,		N/A
	— restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a control device placed outside the hazard zone, where this zone can be observed by the operator,		N/A
	— the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and		N/A
	— the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected.		N/A
	For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices, IEC 61496 should be taken into account.		N/A
6.3.2.5.3	Additional requirements for sensitive protective equipment when used for cycle initiation		-
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control.		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	Cycle initiation by sensitive protective equipment shall be subject to the following conditions:		N/A
	a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used;		N/A
	b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control and braking systems;		N/A
	c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle;		N/A
	d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone;		N/A
	e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation;		N/A
	f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions.		N/A
6.3.2.6	Protective measures for stability		-
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as		-
	— anchorage bolts,		P
	— locking devices,		N/A
	— movement limiters or mechanical stops,		N/A
	— acceleration or deceleration limiters,		N/A
	— load limiters, and		N/A
	— alarms warning of the approach to stability or tipping limits.		N/A
6.3.2.7	Other protective devices		-
	When a machine requires continuous control by the operator (for example, mobile machines, cranes) and an error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular		N/A
	— when the operator has insufficient visibility of the hazard zone,		N/A
	— when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed, mass, angle, etc.), and		N/A
	— when hazards can result from operations other than those controlled by the operator.		N/A
	The necessary devices include		-
	a) devices for limiting parameters of movement (distance, angle, velocity, acceleration),		N/A
	b) overloading and moment limiting devices,		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	c) devices to prevent collisions or interference with other machines,		N/A
	d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians,		N/A
	e) torque limiting devices, and breakage points to prevent excessive stress of components and assemblies,		N/A
	f) devices for limiting pressure or temperature,		N/A
	g) devices for monitoring emissions,		N/A
	h) devices to prevent operation in the absence of the operator at the control position,		N/A
	i) devices to prevent lifting operations unless stabilizers are in place,		N/A
	j) devices to limit inclination of the machine on a slope, and		N/A
	k) devices to ensure that components are in a safe position before travelling.		N/A
	Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3).		N/A
6.3.3	Requirements for design of guards and protective devices		-
6.3.3.1	General requirements		-
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them.	Pass Muster	P
	Guards and protective devices shall		-
	a) be of robust construction,		P
	b) not give rise to any additional hazard,		P
	c) not be easy to bypass or render non-operational,		P
	d) be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857),		P
	e) cause minimum obstruction to the view of the production process, and		P
	f) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out — if possible, without the guard having to be removed or protective device having to be disabled.		P
	For openings in the guards, see ISO 13857.		-
6.3.3.2	Requirements for guards		-
6.3.3.2.1	Functions of guards		-
	The functions that guards can achieve are		-
	— prevention of access to the space enclosed by the guard, and/or		P

Clause	Requirement-Test	Result-Remark	Verdict
	— containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation, hazardous substances such as dust, fumes, gases) that can be generated by the machine.	These functions are achieved by fixed guards.	P
	Additionally, they could need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility (see ISO 14120) and operator position ergonomics (for example, usability, operator's movements, postures, repetitive movements).	These functions are achieved by fixed guards.	P
6.3.3.2.2	Requirements for fixed guards		-
	Fixed guards shall be securely held in place either		-
	— permanently (for example by welding), or		P
	— by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120).	All the fixed guards are securely held in place by appropriate fasteners.	P
6.3.3.2.3	Requirements for movable guards		-
	Movable guards which provide protection against hazards generated by moving transmission parts shall		-
	a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and	Gemels are used for the movable guards.	P
	b) be interlocking (with guard locking when necessary) (see ISO 14119).	Interlock switches are used.	P
	See Figure 4.		-
	Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that		P
	— moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary,	Interlocking guards are provided to comply with these requirements.	P
	— they can be adjusted only by an intentional action, such as the use of a tool or a key, and	This requirement is complied with.	P
	— the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6).		P
	See Figure 4 and ISO 14119.		-
6.3.3.2.4	Requirements for adjustable guards		-
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed.		N/A
	Manually adjustable guards shall be		-
	— designed so that the adjustment remains fixed during a given operation, and		N/A
	— readily adjustable without the use of tools.		N/A
6.3.3.2.5	Requirements for interlocking guards with a start function (control guards)		-
	An interlocking guard with a start function may only be used provided that		N/A

Clause	Requirement-Test	Result-Remark	Verdict
	a) all requirements for interlocking guards are satisfied (see ISO 14119),		N/A
	b) the cycle time of the machine is short,		N/A
	c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine,		N/A
	d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120),		N/A
	e) all other guards, whether fixed (removable type) or movable, are interlocking guards,		N/A
	f) the interlocking device associated with the interlocking guard with a start function is designed such that — for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and		N/A
	g) the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.		N/A
6.3.3.2.6	Hazards from guards		-
	Care shall be taken to prevent hazards which could be generated by		
	— the guard construction (sharp edges or corners, material, noise emission, etc.),	No such hazards exist in this machine.	P
	— the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).	No such hazards exist in this machine.	P
6.3.3.3	Technical characteristics of protective devices		-
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured.	This requirement has been taken into account during design.	P
	Protective devices shall be selected on the basis of their having met the appropriate product standard (for example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061.	This requirement has been taken into account during design.	P
	Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.		P
6.3.3.4	Provisions for alternative types of safeguards		-
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.		N/A
6.3.4	Safeguarding to reduce emissions		-
6.3.4.1	General		-
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).	No such hazard exists.	P
6.3.4.2	Noise		-
	Additional protective measures against noise include		-
	— enclosures (see ISO 15667),	No such hazard exists.	P

Clause	Requirement-Test	Result-Remark	Verdict
	<ul style="list-style-type: none"> – screens fitted to the machine, and – silencers (see ISO 14163). 		
6.3.4.3	Vibration		-
	Additional protective measures against vibration include		-
	<ul style="list-style-type: none"> – vibration isolators, such as damping devices placed between the source and the exposed person, – resilient mounting, and – suspended seats. 	No such hazard exists.	P
	For measures for vibration isolation of stationary industrial machinery see EN 1299.		P
6.3.4.4	Hazardous substances		
	Additional protective measures against hazardous substances include		-
	– encapsulation of the machine (enclosure with negative pressure),		N/A
	– local exhaust ventilation with filtration,		N/A
	– wetting with liquids, and		N/A
	– special ventilation in the area of the machine (air curtains, cabins for operators). See ISO 14123-1.		N/A
6.3.4.5	Radiation		-
	Additional protective measures against radiation include		-
	<ul style="list-style-type: none"> – use of filtering and absorption, and – use of attenuating screens or guards. 		N/A
6.3.5	Complementary protective measures		-
6.3.5.1	General		-
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.	Pass Muster	P
6.3.5.2	Components and elements to achieve emergency stop function		-
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply:		
	– the actuators shall be clearly identifiable, clearly visible and readily accessible;	The actuators can be clearly identifiable, clearly visible and readily accessible	P
	– the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;	The hazardous process can be stopped as quickly as possible without creating additional hazards	P
	– the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary.	Pass Muster	P

Clause	Requirement-Test	Result-Remark	Verdict
	Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting.	Reset is necessary before re-start.	P
	More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.		P
6.3.5.3	Measures for the escape and rescue of trapped persons		-
	Measures for the escape and rescue of trapped persons may consist, among others, of		-
	— escape routes and shelters in installations generating operator-trapping hazards,		N/A
	— arrangements for moving some elements by hand, after an emergency stop,		N/A
	— arrangements for reversing the movement of some elements,		N/A
	— anchorage points for descender devices,		N/A
	— means of communication to enable trapped operators to call for help.		N/A
6.3.5.4	Measures for isolation and energy dissipation		-
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions:		P
	a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;	A main switch with lock is provided.	P
	b) locking (or otherwise securing) all the isolating units in the isolating position;	Please see the report for EN 60204	P
	c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy which can give rise to a hazard;	Please see the report for EN 60204	P
	d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect.	Please see the report for EN 60204	P
	See ISO 14118:2000, Clause 5, and IEC 60204-1:2005, 5.5 and 5.6.		P
6.3.5.5	Provisions for easy and safe handling of machines and their heavy component parts		-
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear.	Appropriate attachments are provided.	P
	These attachments may be, among others,		-
	— standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing,	Such devices are used.	P
	— appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground,		N/A
	— fork locating devices for machines to be transported by a lift truck,	Such devices are used.	P
	— lifting and stowing gear and appliances integrated into the machine.		N/A
	Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement. See also 6.4.4 c), item 3).		P
6.3.5.6	Measures for safe access to machinery		-

Clause	Requirement-Test	Result-Remark	Verdict
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance to be carried out as far as possible by a person remaining at ground level.	These requirements have been taken into account during design.	P
	Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery.	Not applicable	N/A
	The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, shall be provided with suitable guard-rails (see ISO 14122-3).		N/A
	In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points.		N/A
	Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for adders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations).		N/A
	Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening.		N/A
	The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access.		N/A
	When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open.		N/A
	For detailed provisions see ISO 14122.		N/A
6.4	Information for use		-
6.4.1	General requirements		-
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2). Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams, used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users.	Please see the related clause.	P
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes.	All the information is stated in the appropriate place.	P
	The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk.		P
	The information shall indicate, as appropriate,		-
	<ul style="list-style-type: none"> — the need for training, — the need for personal protective equipment, and — the possible need for additional guards or protective devices (see Figure 2, Footnote d). 	All the information is stated in the appropriate place.	P
	It shall not exclude uses of the machine that can reasonably be expected from its designation and		

Clause	Requirement-Test	Result-Remark	Verdict
	description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.		
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.		
6.4.2	Location and nature of information for use		-
	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the information — or parts thereof — are to be given	All the information is stated in the appropriate place.	P
	a) in/on the machine itself (see 6.4.3 and 6.4.4),	Adequate information is stated in the machine itself.	P
	b) in accompanying documents (in particular instruction handbook, see 6.4.5),	Adequate information is stated in the accompanying documents	P
	c) on the packaging,	Adequate information is stated on the packaging	P
	d) by other means such as signals and warnings outside the machine.	Adequate information is stated	P
	Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).	This requirement is considered.	P
6.4.3	Signals and warning devices		-
	Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event such as machine start-up or overspeed. Such signals may also be used to warn the operator before the triggering of automatic protective measures (see 6.3.2.7).	Signals and warning devices are provided.	P
	It is essential that these signals		-
	a) be emitted before the occurrence of the hazardous event,		P
	b) be unambiguous,		
	c) be clearly perceived and differentiated from all other signals used, and		P
	d) be clearly recognized by the operator and other persons.		P
	The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices.	Pass Muster	P
	The attention of designers is drawn to the possibility of "sensorial saturation", which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices		P
6.4.4	Markings, signs (pictograms) and written warnings		-
	Machinery shall bear all markings which are necessary		P

Clause	Requirement-Test	Result-Remark	Verdict
	a) for its unambiguous identification, including at least		P
	1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any,	Adequate information is provided.	P
	b) in order to indicate its compliance with mandatory requirements, comprising		-
	1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres),	Adequate information is provided.	P
	c) for its safe use, for example,		-
	1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load, 5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection.	Adequate information is provided.	P
	Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine.	Pass Muster	P
	Signs or written warnings indicating only "Danger" shall not be used.		P
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings.	All the markings are standard.	P
	Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be used.		P
	Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators.	Pass Muster	P
	Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms, symbols and colours in particular).	This requirement is complied with	P
	See IEC 60204-1 as regards marking of electrical equipment. See ISO 4413 and ISO 4414 for hydraulic and pneumatic equipment.		P
6.4.5	Accompanying documents (in particular — instruction handbook)		-
6.4.5.1	Contents		-
	The instruction handbook or other written instructions (for example, on the packaging) shall contain, among others, the following:		P
	a) information relating to transport, handling and storage of the machine, such as		P
	1) storage conditions for the machine, 2) dimensions, mass value(s), position of the centre(s) of gravity, and 3) indications for handling (for example, drawings indicating application points for lifting equipment);	All the related information is stated in the instruction handbook	P
	b) information relating to installation and commissioning of the machine, such as		P
	1) fixing/anchoring and dampening of noise and vibration	All the related	P

Clause	Requirement-Test	Result-Remark	Verdict
	requirements, 2) assembly and mounting conditions, 3) space needed for use and maintenance, 4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation), 5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals;	information is stated in the instruction handbook	
	c) information relating to the machine itself, such as		-
	1) detailed description of the machine, its fittings, guards and/or protective devices, 2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate, 3) diagrams (especially schematic representation of safety functions), 4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used, 5) technical documentation of electrical equipment (see IEC 60204), and 6) documents attesting that the machine complies with mandatory requirements;	All the related information is stated in the instruction handbook	P
	d) information relating to the use of the machine, such as that related to or describing		-
	1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop), 5) risks which could not be eliminated by the protective measures implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required;	All the related information is stated in the instruction handbook	P
	e) information for maintenance, such as		-
	1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and	All the related information is stated in the instruction handbook	P

Clause	Requirement-Test	Result-Remark	Verdict
	5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks);		
	f) information relating to dismantling, disabling and scrapping;		
	g) information for emergency situations, such as		-
	1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects;	All the related information is stated in the instruction handbook	P
	h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to appear clearly separated from each other.		P
6.4.5.2	Production of instruction handbook		-
	The following applies to the production and presentation of the instruction handbook.		P
	a) The type font and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print.		P
	b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together.	All the related information is stated in the instruction handbook	P
	c) Whenever helpful to the understanding, text should be supported by illustrations. These illustrations should be supplemented with written details enabling, for example, manual controls (actuators) to be located and identified. They should not be separated from the accompanying text and should follow sequential operations.	All the related information is stated in the instruction handbook	P
	d) Consideration should be given to presenting information in tabular form where this will aid understanding. Tables should be adjacent to the relevant text.		P
	e) The use of colours should be considered, particularly in relation to components requiring quick identification.		P
	f) When information for use is lengthy, a table of contents and/or an index should be provided.		P
	g) Safety-relevant instructions which involve immediate action should be provided in a form readily available to the operator.		P
6.4.5.3	Drafting and editing information for use		-
	The following applies to the drafting and editing of information for use.		-
	a) Relationship to model: the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number).	P	P
	b) Communication principles: when information for use is being prepared, the communication process "see – think – use" should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, "How?" and "Why?" should be anticipated and the answers provided.	All the related information is stated in the instruction handbook	P
	c) Information for use shall be as simple and as brief as	All the related	P

Clause	Requirement-Test	Result-Remark	Verdict
	possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms.	information is stated in the instruction handbook	
	d) When it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale.	All the related information is stated in the instruction handbook	P
	e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them "keep for future reference". Where information for use is kept in electronic form (CD, DVD, tape, hard disk, etc.), information on safety-related issues that need immediate action shall always be backed up with a hard copy that is readily available.	All the related information is stated in the instruction handbook	P
7	Documentation of risk assessment and risk reduction		-
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of		P
	a) the machinery for which the risk assessment has been made (for example, specifications, limits, intended use);		P
	b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.);		P
	c) the hazards and hazardous situations identified and the hazardous events considered in the risk assessment;		P
	d) the information on which risk assessment was based (see 5.2): 1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.); 2) the uncertainty associated with the data used and its impact on the risk assessment;		P
	e) the risk reduction objectives to be achieved by protective measures;		P
	f) the protective measures implemented to eliminate identified hazards or to reduce risk;		P
	g) residual risks associated with the machinery;		P
	h) the result of the risk assessment (see Figure 1);		P
	i) any forms completed during the risk assessment.		P
	Standards or other specifications used to select protective measures referred to in f) above should be referenced.		P

TEST REPORT

EN 60204-1:2006+A1:2009+AC:2010

Safety of Machinery - Electrical Equipment of Machines -
Part 1: General requirements

Name and address of the testing laboratory	Shanghai Ximo Testing Technology Co.,Ltd NO.5131, CHUANNANFENG ROAD, PUDONG NEW AREA, SHANGHAI, CHINA	Tel: 02158100937 Fax: 02158100927
Name and address of the Applicant	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China	
Name and address of the manufacturer	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China	
Name and address of the Factory (production sites)	ZHEJIANG OKAI VEHICLE CO.,LTD No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China	
Product	Electric Scooter	
Model/type reference	ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G	
Rating and principal Characteristics	See the appended page	
Test Result	See Test Report	
Test report no.	XMT0201704830L/MD,XMT0201704831L/LVD,XMT0201704832L/EMC	
Work carried out by		Signature (签字盖章)
	G. Manager	
Work verified by	Peter	Signature
	Manager	
Date of issue	Feb.01,2018	



Clause	Requirement - test	Result-Remark	Verdict
6	Protection against electric shock		-
6.1	General		-
	The electrical equipment shall provide protection of persons against electric shock from:		-
	– direct contact (see 6.2 and 6.4);		N/A
	– indirect contact (see 6.3 and 6.4).		P
	The measures for this protection given in 6.2, 6.3, and, for PELV, in 6.4, are a recommended selection from IEC 60364-4-41. Where those recommended measures are not practicable, for example due to the physical or operational conditions, other measures from IEC 60364-4-41 may be used.	Protection measures given in 6.2, 6.3 and 6.4	P
6.2	Protection against direct contact		-
6.2.1	General		-
	For each circuit or part of the electrical equipment, the measures of either 6.2.2 or 6.2.3 and, where applicable, 6.2.4 shall be applied.	Protection measures given in 6.2.2 and 6.2.3	P
	Exception: where those measures are not appropriate, other measures for protection against direct contact (for example by using barriers, by placing out of reach, using obstacles, using construction or installation techniques that prevent access) as defined in IEC 60364-4-41 may be applied (see 6.2.5 and 6.2.6).		P
	When the equipment is located in places open to all persons, which can include children, measures of either 6.2.2 with a minimum degree of protection against direct contact corresponding to IP4X or IPXXD (see IEC 60529), or 6.2.3 shall be applied.		P
6.2.2	Protection by enclosures		-
	Live parts shall be located inside enclosures that conform to the relevant requirements of Clauses 4, 11, and 14 and that provide protection against direct contact of at least IP2X or IPXXB (see IEC 60529).		P
	Where the top surfaces of the enclosure are readily accessible, the minimum degree of protection against direct contact provided by the top surfaces shall be IP4X or IPXXD.		-
	Opening an enclosure (i.e. opening doors, lids, covers, and the like) shall be possible only under one of the following conditions:		-
a)	The use of a key or tool is necessary for access. For enclosed electrical operating areas, see IEC 60364-4-41, or IEC 60439-1 as appropriate.		P

Clause	Requirement - test	Result-Remark	Verdict
	All live parts, that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, shall be protected against direct contact to at least IP2X or IPXXB. Other live parts on the inside of doors shall be protected against direct contact to at least IP1X or IPXXA.	Comply with the requirement	P
b)	The disconnection of live parts inside the enclosure before the enclosure can be opened. This may be accomplished by interlocking the door with a disconnecting device (for example, the supply disconnecting device) so that the door can only be opened when the disconnecting device is open and so that the disconnecting device can only be closed when the door is closed.		N/A
	Exception: a special device or tool as prescribed by the supplier can be used to defeat the interlock provided that:		-
	– it is possible at all times while the interlock is defeated to open the disconnecting device and lock the disconnecting device in the OFF (isolated) position or otherwise prevent unauthorised closure of the disconnecting device;		N/A
	– upon closing the door, the interlock is automatically restored;		N/A
	– all live parts, that are likely to be touched when resetting or adjusting devices intended for such operations while the equipment is still connected, are protected against direct contact to at least IP2X or IPXXB and other live parts on the inside of doors are protected against direct contact to at least IP1X or IPXXA;		N/A
	– relevant information is provided with the electrical equipment (see 17.2 b)9) and b)12)).		N/A
	Means shall be provided to restrict access to live parts behind doors not directly interlocked with the disconnecting means to skilled or instructed persons. (See 17.2 b)12)).		N/A
	All parts that are still live after switching off the disconnecting device(s) (see 5.3.5) shall be protected against direct contact to at least IP2X or IPXXB (see IEC 60529). Such parts shall be marked with a warning sign in accordance with 16.2.1 (see also 13.2.4 for identification of conductors by colour).		N/A
	Excepted from this requirement for marking are:		-
	– parts that can be live only because of connection to interlocking circuits and that are distinguished by colour as potentially live in accordance with 13.2.4;		N/A
	– the supply terminals of the supply disconnecting device when the latter is mounted alone in a separate enclosure.		N/A

Clause	Requirement - test	Result-Remark	Verdict
c)	Opening without the use of a key or a tool and without disconnection of live parts shall be possible only when all live parts are protected against direct contact to at least IP2X or IPXXB (see IEC 60529). Where barriers provide this protection, either they shall require a tool for their removal or all live parts protected by them shall be automatically disconnected when the barrier is removed.		N/A
6.2.3	Protection by insulation of live parts		-
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction. Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions.	Not applicable	N/A
6.2.4	Protection against residual voltages		-
	Live parts having a residual voltage greater than 60 V after the supply has been disconnected shall be discharged to 60 V or less within a time period of 5 s after disconnection of the supply voltage provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60 µC or less. Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure containing the capacitances.	No residual voltage	N/A
	In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors (for example pins), the discharge time shall not exceed 1 s, otherwise such conductors shall be protected against direct contact to at least IP2X or IPXXB. If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved (for example in the case of removable collectors on conductor wires, conductor bars, or slip-ring assemblies, see 12.7.4), additional switching devices or an appropriate warning device (for example a warning notice in accordance with 16.1) shall be applied.		N/A
6.2.5	Protection by barriers		-
	For protection by barriers, 412.2 of IEC 60364-4-41 shall apply.		N/A
6.2.6	Protection by placing out of reach or protection by obstacles		-
	For protection by placing out of reach, 412.4 of IEC 60364-4-41 shall		N/A

Clause	Requirement - test	Result-Remark	Verdict
	apply. For protection by obstacles, 412.3 of IEC 60364-4-41 shall apply.		-
	For conductor wire systems or conductor bar systems with a degree of protection less than IP2X, see 12.7.1.		N/A
6.3	Protection against indirect contact		-
6.3.1	General		-
	Protection against indirect contact (3.29) is intended to prevent hazardous situations due to an insulation fault between live parts and exposed conductive parts.		P
	For each circuit or part of the electrical equipment, at least one of the measures in accordance with 6.3.2 to 6.3.3 shall be applied:		-
	– measures to prevent the occurrence of a touch voltage (6.3.2); or		N/A
	– automatic disconnection of the supply before the time of contact with a touch voltage can become hazardous (6.3.3).	Automatic disconnection of the supply	P
6.3.2	Prevention of the occurrence of a touch voltage		-
6.3.2.1	General		-
	Measures to prevent the occurrence of a touch voltage include the following:		-
	– provision of class II equipment or by equivalent insulation;		P
	– electrical separation.		N/A
6.3.2.2	Protection by provision of class II equipment or by equivalent insulation		-
	This measure is intended to prevent the occurrence of touch voltages on the accessible parts through a fault in the basic insulation.		P
	This protection is provided by one or more of the following:		-
	– class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC 61140);		P
	– switchgear and controlgear assemblies having total insulation in accordance with IEC 60439-1;		P
	– supplementary or reinforced insulation in accordance with 413.2 of IEC 60364-4-41.		N/A
6.3.2.3	Protection by electrical separation		-
	Electrical separation of an individual circuit is intended to prevent a touch voltage through contact with exposed conductive parts that can be energized by a fault in the basic insulation of the live parts of that circuit.		N/A
	For this type of protection, the requirements of 413.5 of IEC 60364-4-41 apply.		N/A

Clause	Requirement - test	Result-Remark	Verdict
6.3.3	Protection by automatic disconnection of supply		-
	This measure consists of the interruption of one or more of the line conductors by the automatic operation of a protective device in case of a fault. This interruption shall occur within a sufficiently short time to limit the duration of a touch voltage to a time within which the touch voltage is not hazardous. Interruption times are given in Annex A.		P
	This measure necessitates co-ordination between:		-
	– the type of supply and earthing system;		P
	– the impedance values of the different elements of the protective bonding system;		P
	– the characteristics of the protective devices that detect insulation fault(s).		P
	Automatic disconnection of the supply of any circuit affected by an insulation fault is intended to prevent a hazardous situation resulting from a touch voltage.		P
	This protective measure comprises both:		-
	– protective bonding of exposed conductive parts (see 8.2.3),		P
	– and either:		-
	a) overcurrent protective devices for the automatic disconnection of the supply on detection of an insulation fault in TN systems, or		P
	b) residual current protective devices to initiate the automatic disconnection of the supply on detection of an insulation fault from a live part to exposed conductive parts or to earth in TT systems, or		N/A
	c) insulation monitoring or residual current protective devices to initiate automatic disconnection of IT systems. Except where a protective device is provided to interrupt the supply in the case of the first earth fault, an insulation monitoring device shall be provided to indicate the occurrence of a first fault from a live part to exposed conductive parts or to earth. This insulation monitoring device shall initiate an audible and/or visual signal which shall continue as long as the fault persists.		N/A
	Where automatic disconnection is provided in accordance with a), and disconnection within the time specified in Clause A.1 cannot be assured, supplementary bonding shall be provided as necessary to meet the requirements of Clause A.3.	Pass muster	P
6.4	Protection by the use of PELV		-
6.4.1	General requirements		-
	The use of PELV (Protective Extra-Low Voltage) is to protect persons against electric shock from indirect contact and limited area direct contact (see 8.2.5).		N/A

Clause	Requirement - test	Result-Remark	Verdict
	PELV circuits shall satisfy all of the following conditions:		-
a)	the nominal voltage shall not exceed:		-
	25 V a.c. r.m.s. or 60 V ripple-free d.c. when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or		N/A
b)	one side of the circuit or one point of the source of the supply of that circuit shall be connected to the protective bonding circuit;		N/A
c)	live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer (see IEC 61558-1 and IEC 61558-2-6);		N/A
d)	conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 13.1.3 shall apply;		N/A
e)	plugs and socket-outlets for a PELV circuit shall conform to the following:		-
	1) plugs shall not be able to enter socket-outlets of other voltage systems;		N/A
	2) socket-outlets shall not admit plugs of other voltage systems.		N/A
6.4.2	Sources for PELV		-
	The source for PELV shall be one of the following:		-
	– a safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6;		N/A
	– a source of current providing a degree of safety equivalent to that of the safety isolating transformer (for example a motor generator with winding providing equivalent isolation);		N/A
	– an electrochemical source (for example a battery) or another source independent of a higher voltage circuit (for example a diesel-driven generator);		N/A
	– an electronic power supply conforming to appropriate standards specifying measures to be –taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in 6.4.1.		N/A
7	Protection of equipment		-
7.1	General		-
	This Clause details the measures to be taken to protect equipment		-
	– overcurrent arising from a short circuit;		P

Clause	Requirement - test	Result-Remark	Verdict
	– overload and/or loss of cooling of motors;		N/A
	– abnormal temperature;		N/A
	– loss of or reduction in the supply voltage;		P
	– overspeed of machines/machine elements;		N/A
	– earth fault/residual current;		P
	– incorrect phase sequence;		N/A
	– overvoltage due to lightning and switching surges.		N/A
7.2	Overcurrent protection		-
7.2.1	General		-
	Overcurrent protection shall be provided where the current in a machine circuit can exceed either the rating of any component or the current carrying capacity of the conductors, whichever is the lesser value. The ratings or settings to be selected are detailed in 7.2.10.	Overcurrent protective device is provided	P
7.2.2	Supply conductors		-
	Unless otherwise specified by the user, the supplier of the electrical equipment is not responsible for providing the overcurrent protective device for the supply conductors to the electrical equipment (see Annex B).		P
	The supplier of the electrical equipment shall state on the installation diagram the data necessary for selecting the overcurrent protective device (see 7.2.10 and 17.4).	There are relative statements	P
7.2.3	Power circuits		-
	Devices for detection and interruption of overcurrent, selected in accordance with 7.2.10, shall be applied to each live conductor.		P
	The following conductors, as applicable, shall not be disconnected without disconnecting all associated live conductors:		-
	– the neutral conductor of a.c. power circuits;		N/A
	– the earthed conductor of d.c. power circuits;		N/A
	– d.c. power conductors bonded to exposed conductive parts of mobile machines.		N/A
	Where the cross-sectional area of the neutral conductor is at least equal to or equivalent to that of the phase conductors, it is not necessary to provide overcurrent detection for the neutral conductor nor a disconnecting device for that conductor. For a neutral conductor with a cross-sectional area smaller than that of the associated phase conductors, the measures detailed in 524 of IEC 60364-5-52 shall apply.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	In IT systems, it is recommended that the neutral conductor is not used. However, where a neutral conductor is used, the measures detailed in 431.2.2 of IEC 60364-4-43 shall apply.		N/A
7.2.4	Control circuits		-
	Conductors of control circuits directly connected to the supply voltage and of circuits supplying control circuit transformers shall be protected against overcurrent in accordance with 7.2.3.	Overcurrent protective device is provided	P
	Conductors of control circuits supplied by a control circuit transformer or d.c. supply shall be protected against overcurrent (see also 9.4.3.1):		P
	– in control circuits connected to the protective bonding circuit, by inserting an overcurrent protective device into the switched conductor;		P
	– in control circuits not connected to the protective bonding circuit;		N/A
	- where the same cross sectional area conductors are used in all control circuits, by inserting an overcurrent protective device into the switched conductor, and;		P
	- where different cross sectional areas conductors are used in different sub-circuits, by inserting an overcurrent protective device into both switched and common conductors of each sub-circuit.		N/A
7.2.5	Socket outlets and their associated conductors		-
	Overcurrent protection shall be provided for the circuits feeding the general purpose socket outlets intended primarily for supplying power to maintenance equipment. Overcurrent protective devices shall be provided in the unearthed live conductors of each circuit feeding such socket outlets.	Comply with the requirement	P
7.2.6	Lighting circuits		-
	All unearthed conductors of circuits supplying lighting shall be protected against the effects of short circuits by the provision of overcurrent devices separate from those protecting other circuits.		N/A
7.2.7	Transformers		-
	Transformers shall be protected against overcurrent in accordance with the manufacturer's instructions. Such protection shall (see also 7.2.10):		-
	– avoid nuisance tripping due to transformer magnetizing inrush currents;		P
	– avoid a winding temperature rise in excess of the permitted value for the insulation class of transformer when it is subjected to the effects of a short circuit at its secondary terminals.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	The type and setting of the overcurrent protective device should be in accordance with the recommendations of the transformer supplier.	Control circuits, power supply overall protection	P
7.2.8	Location of overcurrent protective devices		-
	An overcurrent protective device shall be located at the point where a reduction in the crosssectional area of the conductors or another change reduces the current-carrying capacity of the conductors, except where all the following conditions are satisfied:	Comply with the requirement	P
	– the current carrying capacity of the conductors is at least equal to that of the load;		P
	– the part of the conductor between the point of reduction of current-carrying capacity and the position of the overcurrent protective device is no longer than 3 m;		P
	– the conductor is installed in such a manner as to reduce the possibility of a short-circuit, for example, protected by an enclosure or duct.		P
7.2.9	Overcurrent protective devices		-
	The rated short-circuit breaking capacity shall be at least equal to the prospective fault current at the point of installation. Where the short-circuit current to an overcurrent protective device can include additional currents other than from the supply (for example from motors, from power factor correction capacitors), those currents shall be taken into consideration.	Installation location of overcurrent protective device meets the requirement.	P
	A lower breaking capacity is permitted where another protective device (for example the overcurrent protective device for the supply conductors (see 7.2.2) having the necessary breaking capacity is installed on the supply side. In that case, the characteristics of the two devices shall be co-ordinated so that the let-through energy (I^2t) of the two devices in series does not exceed that which can be withstood without damage to the overcurrent protective device on the load side and to the conductors protected by that device (see Annex A of IEC 60947-2).	The breaking capacity meets the requirement.	P
	Where fuses are provided as overcurrent protective devices, a type readily available in the country of use shall be selected, or arrangements shall be made for the supply of spare parts.		P
7.2.10	Rating and setting of overcurrent protective devices		-
	The rated current of fuses or the setting current of other overcurrent protective devices shall be selected as low as possible but adequate for the anticipated overcurrents (for example during starting of motors or energizing of transformers). When selecting those protective devices, consideration shall be given to the protection of switching devices against damage due to overcurrents (for example welding of the switching device contacts).	Rating and setting of overcurrent protective devices meet the requirement.	P

Clause	Requirement - test	Result-Remark	Verdict
	The rated current or setting of an overcurrent protective device is determined by the current carrying capacity of the conductors to be protected in accordance with 12.4, D.2 and the maximum allowable interrupting time t in accordance with Clause D.3, taking into account the needs of co-ordination with other electrical devices in the protected circuit.		P
7.3	Protection of motors against overheating		-
7.3.1	General		-
	Protection of motors against overheating shall be provided for each motor rated at more than 0,5 kW.		P
	Exceptions: In applications where an automatic interruption of the motor operation is unacceptable (for example fire pumps), the means of detection shall give a warning signal to which the operator can respond.		P
	Protection of motors against overheating can be achieved by:		-
	– overload protection (7.3.2),		P
	– over-temperature protection (7.3.3), or		P
	– current-limiting protection (7.3.4).		P
	Automatic restarting of any motor after the operation of protection against overheating shall be prevented where this can cause a hazardous situation or damage to the machine or to the work in progress.		P
7.3.2	Overload protection		-
	Where overload protection is provided, detection of overload(s) shall be provided in each live conductor except for the neutral conductor. However, where the motor overload detection is not used for cable overload protection (see also Clause D.2), the number of overload detection devices may be reduced at the request of the user (see also Annex B). For motors having single-phase or d.c. power supplies, detection in only one unearthed live conductor is permitted.	Compressor motors internally installed over-load protector	P
	Where overload protection is achieved by switching off, the switching device shall switch off all live conductors. The switching of the neutral conductor is not necessary for overload protection.		P
	Where motors with special duty ratings are required to start or to brake frequently (for example, motors for rapid traverse, locking, rapid reversal, sensitive drilling) it can be difficult to provide overload protection with a time constant comparable with that of the winding to be protected. Appropriate protective devices designed to accommodate special duty motors or over-temperature protection (see 7.3.3) can be necessary.		P

Clause	Requirement - test	Result-Remark	Verdict
	For motors that cannot be overloaded (for example torque motors, motion drives that either are protected by mechanical overload protection devices or are adequately dimensioned), overload protection is not required.		P
7.3.3	Over-temperature protection		-
	The provision of motors with over-temperature protection (see IEC 60034-11) is recommended in situations where the cooling can be impaired (for example dusty environments). Depending upon the type of motor, protection under stalled rotor or loss of phase conditions is not always ensured by over-temperature protection, and additional protection should then be provided.	Compressor motors internally installed over- temperature protector	P
	Over-temperature protection is also recommended for motors that cannot be overloaded (for example torque motors, motion drives that are either protected by mechanical overload protection devices or are adequately dimensioned), where the possibility of over-temperature exists (for example due to reduced cooling).		P
7.3.4	Current limiting protection		-
	Where protection against the effects of overheating in three phase motors is achieved by current limitation, the number of current limitation devices may be reduced from 3 to 2 (see 7.3.2). For motors having single phase a.c or d.c. power supplies, current limitation in only one unearthed live conductor is permitted.		N/A
7.4	Abnormal temperature protection		-
	Resistance heating or other circuits that are capable of attaining or causing abnormal temperatures (for example, due to short-time rating or loss of cooling medium) and therefore can cause a hazardous situation shall be provided with suitable detection to initiate an appropriate control response.	No corresponding circuit	N/A
7.5	Protection against supply interruption or voltage reduction and subsequent Restoration		-
	Where a supply interruption or a voltage reduction can cause a hazardous situation, damage to the machine, or to the work in progress, undervoltage protection shall be provided by, for example, switching off the machine at a predetermined voltage level.		P
	Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed undervoltage protection may be provided. The operation of the undervoltage device shall not impair the operation of any stopping control of the machine.		P

Clause	Requirement - test	Result-Remark	Verdict
	Upon restoration of the voltage or upon switching on the incoming supply, automatic or unexpected restarting of the machine shall be prevented where such a restart can cause a hazardous situation.	Automatic or unexpected restarting of the machine can be prevented	P
	Where only a part of the machine or of the group of machines working together in a coordinated manner is affected by the voltage reduction or supply interruption, the undervoltage protection shall initiate appropriate control responses to ensure co-ordination.		P
7.6	Motor overspeed protection		-
	Overspeed protection shall be provided where overspeeding can occur and could possibly cause a hazardous situation taking into account measures in accordance with 9.3.2. Overspeed protection shall initiate appropriate control responses and shall prevent automatic restarting.		N/A
	The overspeed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded.		N/A
7.7	Earth fault/residual current protection		-
	In addition to providing overcurrent protection for automatic disconnection as described in 6.3, earth fault/residual current protection can be provided to reduce damage to equipment due to earth fault currents less than the detection level of the overcurrent protection.		N/A
	The setting of the devices shall be as low as possible consistent with correct operation of the equipment.		N/A
7.8	Phase sequence protection		-
	Where an incorrect phase sequence of the supply voltage can cause a hazardous situation or damage to the machine, protection shall be provided.		N/A
7.9	Protection against overvoltages due to lightning and to switching surges		-
	Protective devices can be provided to protect against the effects of overvoltages due to lightning or to switching surges.		N/A
	Where provided:		-
	– devices for the suppression of overvoltages due to lightning shall be connected to the incoming terminals of the supply disconnecting device.		N/A
	– devices for the suppression of overvoltages due to switching surges shall be connected across the terminals of all equipment requiring such protection.		-
8	Equipotential bonding		-
8.1	General		-

Clause	Requirement - test	Result-Remark	Verdict
	This Clause provides requirements for both protective bonding and functional bonding. Figure 2 illustrates those concepts.		-
	Protective bonding is a basic provision for fault protection to enable protection of persons against electric shock from indirect contact (see 6.3.3 and 8.2).	Pass muster	P
	The objective of functional bonding (see 8.3) is to minimize:		-
	– the consequence of an insulation failure which could affect the operation of the machine;	Pass muster	P
	– the consequences of electrical disturbances to sensitive electrical equipment which could affect the operation of the machine.		N/A
	Normally functional bonding is achieved by connection to the protective bonding circuit, but where the level of electrical disturbances on the protective bonding circuit is not sufficiently low for proper functioning of electrical equipment, it may be necessary to connect the functional bonding circuit to a separate functional earthing conductor (see Figure 2).	Comply with the Figure 2	P
8.2	Protective bonding circuit		-
8.2.1	General		-
	The protective bonding circuit consists of:		-
	– PE terminal(s) (see 5.2);		P
	– the protective conductors in the equipment of the machine including sliding contacts where they are part of the circuit;	Pass muster	P
	– the exposed conductive parts and conductive structural parts of the electrical equipment;		N/A
	– those extraneous conductive parts which form the structure of the machine.		N/A
	All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.	Pass muster	P
	Where the conductance of structural parts of the electrical equipment or of the machine is less than that of the smallest protective conductor connected to the exposed conductive parts, a supplementary bonding conductor shall be provided. This supplementary bonding conductor shall have a cross-sectional area not less than half that of the corresponding protective conductor.	Pass muster	P
	If an IT distribution system is used, the machine structure shall be part of the protective bonding circuit and insulation monitoring shall be provided. See 6.3.3 c).	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	Conductive structural parts of equipment in accordance with 6.3.2.2 need not be connected to the protective bonding circuit. Extraneous conductive parts which form the structure of the machine need not be connected to the protective bonding circuit where all the equipment provided is in accordance with 6.3.2.2.	Pass muster	P
	Exposed conductive parts of equipment in accordance with 6.3.2.3 shall not be connected to the protective bonding circuit.		N/A
8.2.2	Protective conductors		-
	Protective conductors shall be identified in accordance with 13.2.2.		P
	Copper conductors are preferred. Where a conductor material other than copper is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm ² in cross-sectional area.		N/A
	The cross-sectional area of protective conductors shall be determined in accordance with the requirements of:		-
	– 543 of IEC 60364-5-54; or		N/A
	– 7.4.3.1.7 of IEC 60439-1, as appropriate.		P
	This requirement is met in most cases where the relationship between the cross-sectional area of the phase conductors associated with that part of the equipment and the cross-sectional area of the associated protective conductor is in accordance with Table 1 (see 5.2).	In accordance with Table 1	P
	See also 8.2.8.		N/A
8.2.3	Continuity of the protective bonding circuit		-
	All exposed conductive parts shall be connected to the protective bonding circuit in accordance with 8.2.1.	Pass muster	P
	Exception: see 8.2.5.		-
	Where a part is removed for any reason (for example routine maintenance), the protective bonding circuit for the remaining parts shall not be interrupted.	Pass muster	P
	Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and conductors of aluminium or aluminium alloys are used, particular consideration should be given to the possibility of electrolytic corrosion.	Comply with the requirement	P
	Metal ducts of flexible or rigid construction and metallic cable sheaths shall not be used as protective conductors. Nevertheless, such metal ducts and the metal sheathing of all connecting cables (for example cable armouring, lead sheath) shall be connected to the protective bonding circuit.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	Where the electrical equipment is mounted on lids, doors, or cover plates, continuity of the protective bonding circuit shall be ensured and a protective conductor (see 8.2.2) is recommended. Otherwise fastenings, hinges or sliding contacts designed to have a low resistance shall be used (see 18.2.2, Test 1).	Comply with the requirement	P
	The continuity of the protective conductor in cables that are exposed to damage (for example flexible trailing cables) shall be ensured by appropriate measures (for example monitoring).		N/A
	For requirements for the continuity of the protective conductor using conductor wires, conductor bars and slip-ring assemblies, see 12.7.2.		N/A
8.2.4	Exclusion of switching devices from the protective bonding circuit		-
	The protective bonding circuit shall not incorporate a switching device or an overcurrent protective device (for example switch, fuse).		N/A
	No means of interruption of the protective bonding conductor shall be provided.		N/A
	Exception: links for test or measurement purposes that cannot be opened without the use of a tool and that are located in an enclosed electrical operating area.		N/A
	Where the continuity of the protective bonding circuit can be interrupted by means of removable current collectors or plug/socket combinations, the protective bonding circuit shall be interrupted by a first make last break contact. This also applies to removable or withdrawable plug-in units (see also 13.4.5).		N/A
8.2.5	Parts that need not be connected to the protective bonding circuit		-
	It is not necessary to connect exposed conductive parts to the protective		N/A
	bonding circuit where those parts are mounted so that they do not constitute a hazard because:		
	– they cannot be touched on large surfaces or grasped with the hand and they are small in		-
	– they are located so that either contact with live parts, or an insulation failure, is unlikely.		N/A
	This applies to small parts such as screws, rivets, and nameplates and to parts inside an enclosure, irrespective of their size (for example electromagnets of contactors or relays and mechanical parts of devices) (see also 410.3.3.5 of IEC 60364-4-41).		N/A
8.2.6	Protective conductor connecting points		-
	All protective conductors shall be terminated in accordance with 13.1.1. The protective conductor connecting points shall have no other function and are not intended, for example, to attach or connect appliances or parts.	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	Each protective conductor connecting point shall be marked or labeled as such using the symbol IEC 60417-5019 (DB:2002-10):		N/A
	or with the letters PE , the graphical symbol being preferred, or by use of the bicolour combination GREEN-AND-YELLOW, or by any combination of these.	Pass muster	P
8.2.7	Mobile machines		-
	On mobile machines with on-board power supplies, the protective conductors, the conductive structural parts of the electrical equipment, and those extraneous conductive parts which form the structure of the machine shall all be connected to a protective bonding terminal to provide protection against electric shock. Where a mobile machine is also capable of being connected to an external incoming power supply, this protective bonding terminal shall be the connection point for the external protective conductor.		N/A
8.2.8	Additional protective bonding requirements for electrical equipment having earth leakage currents higher than 10 mA a.c. or d.c.		-
	Where electrical equipment has an earth leakage current (for example adjustable speed electrical power drive systems and information technology equipment) that is greater than 10 mA a.c. or d.c. in any incoming supply, one or more of the following conditions for the associated protective bonding circuit shall be satisfied:		N/A
a)	the protective conductor shall have a cross-sectional area of at least 10 mm ² Cu or 16 mm ² Al, through its total run;		N/A
b)	where the protective conductor has a cross-sectional area of less than 10 mm ² Cu or 16 mm ² Al, a second protective conductor of at least the same cross-sectional area shall be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm ² Cu or 16 mm ² Al. automatic disconnection of the supply in case of loss of continuity of the protective conductor		N/A
c)	To prevent difficulties associated with electromagnetic disturbances, the requirements of 4.4.2 also apply to the installation of duplicate protective conductors.		N/A
	In addition, a warning label shall be provided adjacent to the PE terminal, and where necessary on the nameplate of the electrical equipment. The information provided under 17.2 b)1) shall include information about the leakage current and the minimum cross-sectional area of the external protective conductor.		N/A
8.3	Functional bonding		-
	Protection against maloperation as a result of insulation failures can be achieved by connecting to a common conductor in accordance with 9.4.3.1.		N/A
	For recommendations regarding functional bonding to avoid maloperation due to electromagnetic disturbances, see 4.4.2.		N/A

Clause	Requirement - test	Result-Remark	Verdict
8.4	Measures to limit the effects of high leakage current		-
	The effects of high leakage current can be restricted to the equipment having high leakage current by connection of that equipment to a dedicated supply transformer having separate windings. The protective bonding circuit shall be connected to exposed conductive parts of the equipment and, in addition, to the secondary winding of the transformer. The protective conductor(s) between the equipment and the secondary winding of the transformer shall comply with one or more of the arrangements described in 8.2.8.		N/A
9	Control circuits and control functions		-
9.1	Control circuits		-
9.1.1	Control circuit supply		-
	Where control circuits are supplied from an a.c. source, control transformers shall be used for supplying the control circuits. Such transformers shall have separate windings. Where several transformers are used, it is recommended that the windings of those transformers be connected in such a manner that the secondary voltages are in phase.	Control transformers supplying the control circuits	P
	Where d.c. control circuits derived from an a.c. supply are connected to the protective bonding circuit (see 8.2.1), they shall be supplied from a separate winding of the a.c. control circuit transformer or by another control circuit transformer.		N/A
	Transformers are not mandatory for machines with a single motor starter and/or a maximum of two control devices (for example interlock device, start/stop control station).		P
9.1.2	Control circuit voltages		-
	The nominal value of the control voltage shall be consistent with the correct operation of the control circuit. The nominal voltage shall not exceed 277 V when supplied from a transformer.	220V	P
9.1.3	Protection		-
	Control circuits shall be provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.	Overcurrent protection is provided	P
9.2	Control functions		-
	NOTE 1 Information on the safety-related aspects of control functions is given in ISO 13849-1 (1999), ISO 13849-2 (2003), and IEC 62061.		-
	NOTE 2 This subclause does not specify requirements for the equipment used to implement control functions. Examples of such requirements are given in Clause 10.		-
9.2.1	Start functions		-
	Start functions shall operate by energizing the relevant circuit (see 9.2.5.2).	Pass muster	P
9.2.2	Stop functions		-

Clause	Requirement - test	Result-Remark	Verdict
	There are three categories of stop functions as follows:		-
	– stop category 0: stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop – see 3.56);		N/A
	– stop category 1: a controlled stop (see 3.11) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;	Stop category 1	P
	– stop category 2: a controlled stop with power left available to the machine actuators.		N/A
9.2.3	Operating modes		-
	Each machine can have one or more operating modes determined by the type of machine and its application. When a hazardous situation can result from a mode selection, unauthorised and/or inadvertent selection shall be prevented by suitable means (for example key operated switch, access code).		N/A
	Mode selection by itself shall not initiate machine operation. A separate actuation of the start control shall be required.		N/A
	For each specific operating mode, the relevant safety functions and/or protective measures shall be implemented.		N/A
	Indication of the selected operating mode shall be provided (for example the position of a mode selector, the provision of an indicating light, a visual display indication).		N/A
9.2.4	Suspension of safety functions and/or protective measures		-
	Where it is necessary to suspend safety functions and/or protective measures (for example for setting or maintenance purposes), protection shall be ensured by:		-
	– disabling all other operating (control) modes; and		N/A
	– other relevant means (see 4.11.9 of ISO 12100-2:2003), that can include, for example, one or more of the following:		-
	- initiation of operation by a hold-to-run device or by a similar control device;		N/A
	- a portable control station with an emergency stop device and, where appropriate, an enabling device. Where a portable control station is in use, initiation of motion shall only be possible from that control station;		N/A
	- a cableless control station with a device to initiate stop functions in accordance with 9.2.7.3 and, where appropriate, an enabling device. Where a cableless control station is in use, initiation of motion shall only be possible from that control station;		N/A
	- limitation of the speed or the power of motion;		N/A
	- limitation of the range of motion.	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
9.2.5	Operation		-
9.2.5.1	General		-
	The necessary safety functions and/or protective measures (for example interlocks (see 9.3)) shall be provided for safe operation.	protective measures are provided	P
	Measures shall be taken to prevent movement of the machine in an unintended or unexpected manner after any stopping of the machine (for example due to locked-off condition, power supply fault, battery replacement, lost signal condition with cableless control).	Pass muster	P
	Where a machine has more than one control station, measures shall be provided to ensure that initiation of commands from different control stations do not lead to a hazardous situation.		N/A
9.2.5.2	Start		-
	The start of an operation shall be possible only when all of the relevant safety functions and/or protective measures are in place and are operational except for conditions as described in 9.2.4.	Pass muster	P
	On those machines (for example mobile machines) where safety functions and/or protective measures cannot be applied for certain operations, manual control of such operations shall be by hold-to-run controls, together with enabling devices, as appropriate.		N/A
	Suitable interlocks shall be provided to secure correct sequential\ starting.		N/A
	In the case of machines requiring the use of more than one control station to initiate a start, each of these control stations shall have a separate manually actuated start control device. The conditions to initiate a start shall be:		N/A
	– all required conditions for machine operation shall be met, and		N/A
	– all start control devices shall be in the released (off) position, then		N/A
	– all start control devices shall be actuated concurrently		N/A
9.2.5.3	Stop		-
	Stop category 0 and/or stop category 1 and/or stop category 2 stop functions shall be provided as indicated by the risk assessment and the functional requirements of the machine (see 4.1).	Stop category 1	P
	Stop functions shall override related start functions (see 9.2.5.2).		P
	Where required, facilities to connect protective devices and interlocks shall be provided. If such a protective device or interlock causes a stop of the machine, it may be necessary for that condition to be signalled to the logic of the control system. The reset of the stop function shall not initiate any hazardous situation.	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	Where more than one control station is provided, stop commands from any control station shall be effective when required by the risk assessment of the machine.		N/A
9.2.5.4	Emergency operations (emergency stop, emergency switching off)		-
9.2.5.4.1	General		-
	This part of IEC 60204 specifies the requirements for the emergency stop and the emergency switching off functions of the emergency operations listed in Annex E, both of which are, in this part of IEC 60204, initiated by a single human action.		-
	Once active operation of an emergency stop (see 10.7) or emergency switching off (see 10.8) actuator has ceased following a command, the effect of this command shall be sustained until it is reset. This reset shall be possible only by a manual action at that location where the command has been initiated. The reset of the command shall not restart the machinery but only permit restarting.	Comply with the requirement	P
	It shall not be possible to restart the machinery until all emergency stop commands have been reset. It shall not be possible to reenergize the machinery until all emergency switching off commands have been reset.	Pass muster	P
	NOTE: Emergency stop and emergency switching off are complementary protective measures that are not primary means of risk reduction for hazards (for example trapping, entanglement, electric shock or burn) at a machine (see ISO 12100 (all parts)).		P
9.2.5.4.2	Emergency stop		-
	Principles for the design of emergency stop equipment, including functional aspects, are given in ISO 13850.		-
	The emergency stop shall function either as a stop category 0 or as a stop category 1 (see 9.2.2). The choice of the stop category of the emergency stop depends on the results of a risk assessment of the machine.	Pass muster	P
	In addition to the requirements for stop (see 9.2.5.3), the emergency stop function has the following requirements:		-
	– it shall override all other functions and operations in all modes;		P
	– power to the machine actuators that can cause a hazardous situation(s) shall be either removed immediately (stop category 0) or shall be controlled in such a way to stop the hazardous motion as quickly as possible (stop category 1) without creating other hazards;	Stop category 1	P
	– reset shall not initiate a restart.		P
9.2.5.4.3	Emergency switching off		-
	The functional aspects of emergency switching off are given in 536.4 of IEC 60364-5-53.		N/A
	Emergency switching off should be provided where:		-
	– protection against direct contact (for example with conductor wires, conductor bars, slipring assemblies, controlgear in electrical operating areas) is achieved only		N/A

Clause	Requirement - test	Result-Remark	Verdict
	by placing out of reach or by obstacles (see 6.2.6); or		N/A
	– there is the possibility of other hazards or damage caused by electricity.		N/A
	Emergency switching off is accomplished by switching off the relevant incoming supply by electromechanical switching devices, effecting a stop category 0 of machine actuators connected to this incoming supply. When a machine cannot tolerate this stop category 0 stop, it may be necessary to provide other measures, for example protection against direct contact, so that emergency switching off is not necessary.		N/A
9.2.5.5	Monitoring of command actions		-
	Movement or action of a machine or part of a machine that can result in a hazardous situation shall be monitored by providing, for example, overtravel limiters, motor overspeed detection, mechanical overload detection or anti-collision devices.		N/A
9.2.6	Other control functions		-
9.2.6.1	Hold-to-run controls		-
	Hold-to-run controls shall require continuous actuation of the control device(s) to achieve operation.		N/A
9.2.6.2	Two-hand control		-
	Three types of two-hand control are defined in ISO 13851, the selection of which is determined by the risk assessment. These shall have the following features:		N/A
Type I	this type requires:		-
	– the provision of two control devices and their concurrent actuation by both hands;		-
	– continuous concurrent actuation during the hazardous situation;		N/A
	– machine operation shall cease upon the release of either one or both of the control devices when hazardous situations are still present.		N/A
	A Type I two-hand control device is not considered to be suitable for the initiation of hazardous operation.		N/A
Type II	a type I control requiring the release of both control devices before machine operation can be reinitiated.		N/A
Type III	a type II control requiring concurrent actuation of the control devices as follows:		N/A
	– it shall be necessary to actuate the control devices within a certain time limit of each other, not exceeding 0,5 s;		N/A
	– where this time limit is exceeded, both control devices shall be released before machine operation can be initiated.		N/A

Clause	Requirement - test	Result-Remark	Verdict
9.2.6.3	Enabling control		-
	Enabling control (see also 10.9) is a manually activated control function interlock that:		-
a)	when activated allows a machine operation to be initiated by a separate start control, and Licensed Copy: Wang Bin, na, Fri Aug 25 01:48:36 BST 2006, Uncontrolled Copy, (c) BSI		N/A
b)	when de-activated		-
	– initiates a stop function in accordance with 9.2.5.3, and		N/A
	– prevents initiation of machine operation.		N/A
	Enabling control shall be so arranged as to minimize the possibility of defeating, for example by requiring the de-activation of the enabling control device before machine operation may be reinitiated. It should not be possible to defeat the enabling function by simple means.		N/A
9.2.6.4	Combined start and stop controls		-
	Push-buttons and similar control devices that, when operated, alternately initiate and stop motion shall only be provided for functions which cannot result in a hazardous situation.		N/A
9.2.7	Cableless control		-
9.2.7.1	General		-
	This subclause deals with the functional requirements of control systems employing cableless (for example radio, infra-red) techniques for transmitting commands and signals between a machine control system and operator control station(s).		N/A
	Means shall be provided to readily remove or disconnect the power supply of the operator control station (see also 9.2.7.3).		N/A
	Means (for example key operated switch, access code) shall be provided, as necessary, to prevent unauthorized use of the operator control station.		N/A
	Each operator control station shall carry an unambiguous indication of which machine(s) is (are) intended to be controlled by that operator control station.		N/A
9.2.7.2	Control limitation		-
	Measures shall be taken to ensure that control commands:		-
	– affect only the intended machine;		N/A
	– affect only the intended functions.		N/A
	Measures shall be taken to prevent the machine from responding to signals other than those from the intended operator control station(s).		N/A

Clause	Requirement - test	Result-Remark	Verdict
	Where necessary, means shall be provided so that the machine can only be controlled from operator control stations in one or more predetermined zones or locations.		N/A
9.2.7.3	Stop		-
	Cableless control stations shall include a separate and clearly identifiable means to initiate the stop function of the machine or of all the operations that can cause a hazardous situation. The actuating means to initiate this stop function shall not be marked or labelled as an emergency stop device (see 10.7).		N/A
	A machine which is equipped with cableless control shall have a means of automatically initiating the stopping of the machine and of preventing a potentially hazardous operation, in the following situations:		N/A
	– when a stop signal is received;		N/A
	– when a fault is detected in the cableless control system;		N/A
	– when a valid signal (which includes a signal that communication is established and maintained) has not been detected within a specified period of time (see Annex B), except when a machine is executing a pre-programmed task taking it outside the range of the cableless control where no hazardous situation can occur.		N/A
9.2.7.4	Use of more than one operator control station		-
	Where a machine has more than one operator control station, including one or more cableless control stations, measures shall be provided to ensure that only one of the control stations can be enabled at a given time. An indication of which operator control station is in control of the machine shall be provided at suitable locations as determined by the risk assessment of the machine.		N/A
	Exception: a stop command from any one of the control stations shall be effective when required by the risk assessment of the machine.		N/A
9.2.7.5	Battery-powered operator control stations		-
	A variation in the battery voltage shall not cause a hazardous situation. If one or more potentially hazardous motions are controlled using a battery-powered cableless operator control station, a clear warning shall be given to the operator when a variation in battery voltage exceeds specified limits. Under those circumstances, the cableless operator control station shall remain functional long enough for the operator to put the machine into a nonhazardous situation.		N/A

Clause	Requirement - test	Result-Remark	Verdict
9.3	Protective interlocks		-
9.3.1	Reclosing or resetting of an interlocking safeguard		-
	The reclosing or resetting of an interlocking safeguard shall not initiate hazardous machine operation.	Pass muster	P
9.3.2	Exceeding operating limits		-
	Where an operating limit (for example speed, pressure, position) can be exceeded leading to a hazardous situation, means shall be provided to detect when a predetermined limit(s) is exceeded and initiate an appropriate control action.		N/A
9.3.3	Operation of auxiliary functions		-
	The correct operation of auxiliary functions shall be checked by appropriate devices (for example pressure sensors).	Pass muster	P
	Where the non-operation of a motor or device for an auxiliary function (for example lubrication, supply of coolant, swarf removal) can cause a hazardous situation, or cause damage to the machine or to the work in progress, appropriate interlocking shall be provided.	Pass muster	P
9.3.4	Interlocks between different operations and for contrary motions		-
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous situation when actuated at the same time (for example those which initiate contrary motion), shall be interlocked against incorrect operation.		-
	Reversing contactors (for example those controlling the direction of rotation of a motor) shall be interlocked in such a way that in normal service no short circuit can occur when switching.		N/A
	Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination shall be ensured by suitable interlocks. For a group of machines working together in a co-ordinated manner and having more than one controller, provision shall be made to co-ordinate the operations of the controllers as necessary.		N/A
	Where a failure of a mechanical brake actuator can result in the brake being applied when the associated machine actuator is energized and a hazardous situation can result, interlocks shall be provided to switch off the machine actuator.		N/A
9.3.5	Reverse current braking		-
	Where braking of a motor is accomplished by current reversal, measures shall be provided to prevent the motor starting in the opposite direction at the end of braking where that reversal can cause a		N/A

Clause	Requirement - test	Result-Remark	Verdict
	hazardous situation or damage to the machine or to the work in progress. For this purpose, a device operating exclusively as a function of time is not permitted.		N/A
	Control circuits shall be so arranged that rotation of a motor shaft, for example manually, shall not result in a hazardous situation.		N/A
9.4	Control functions in the event of failure		-
9.4.1	General requirements		-
	Where failures or disturbances in the electrical equipment can cause a hazardous situation or damage to the machine or to the work in progress, appropriate measures shall be taken to minimize the probability of the occurrence of such failures or disturbances. The required measures and the extent to which they are implemented, either individually or in combination, depend on the level of risk associated with the respective application (see 4.1).	Comply with the requirement	P
	The electrical control circuits shall have an appropriate level of safety performance that has been determined from the risk assessment at the machine. The requirements of IEC 62061 and/or ISO 13849-1:1999, ISO 13849-2:2003 shall apply.	Pass muster	P
	Measures to reduce those risks include but are not limited to:		-
	– protective devices on the machine (for example interlocking guards, trip devices);		N/A
	– protective interlocking of the electrical circuit;		P
	– use of proven circuit techniques and components (see 9.4.2.1);		N/A
	– provision of partial or complete redundancy (see 9.4.2.2) or diversity		N/A
	– provision for functional tests (see 9.4.2.4).		P
	Where memory retention is achieved for example, by battery power, measures shall be taken to prevent hazardous situations arising from failure or removal of the battery.	Pass muster	P
	Means shall be provided to prevent unauthorized or inadvertent memory alteration by, for example, requiring the use of a key, access code or tool.		-
9.4.2	Measures to minimize risk in the event of failure		-
9.4.2.1	Use of proven circuit techniques and components		-
	These measures include but are not limited to:		-
	– bonding of control circuits to the protective bonding circuit for functional purposes (see 9.4.3.1 and Figure 2);		P
	– connection of control devices in accordance with 9.4.3.1;		P

Clause	Requirement - test	Result-Remark	Verdict
	– stopping by de-energizing (see 9.2.2);		P
	– the switching of all control circuit conductors to the device being controlled (see 9.4.3.1);		N/A
	– switching devices having direct opening action (see IEC 60947-5-1);		N/A
	– circuit design to reduce the possibility of failures causing undesirable operations.		N/A
9.4.2.2	Provisions of partial or complete redundancy		-
	By providing partial or complete redundancy, it is possible to minimize the probability that one single failure in the electrical circuit can result in a hazardous situation. Redundancy can be effective in normal operation (on-line redundancy) or designed as special circuits that take over the protective function (off-line redundancy) only where the operating function fails.	Pass muster	P
	Where off-line redundancy which is not active during normal operation is provided, suitable measures shall be taken to ensure that those control circuits are available when required.		N/A
9.4.2.3	Provision of diversity		-
	The use of control circuits having different principles of operation, or using different types of components or devices can reduce the probability of hazards resulting from faults and/or failures. Examples include:		-
	– the combination of normally open and normally closed contacts operated by interlocking guards;		-
	– the use of different types of control circuit components in the circuit;		N/A
	– the combination of electromechanical and electronic equipment in redundant configurations.		N/A
	The combination of electrical and non-electrical systems (for example mechanical, hydraulic, pneumatic) may perform the redundant function and provide the diversity.		N/A
9.4.2.4	Provision for functional tests		-
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals, or a combination as appropriate (see also 17.2 and 18.6).	Pass muster	P
9.4.3	Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity		-
9.4.3.1	Earth faults		-
	Earth faults on any control circuit shall not cause unintentional starting,	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	potentially hazardous motions, or prevent stopping of the machine.		
	Methods to meet these requirements include but are not limited to the following:		-
Method a)	Control circuits, fed by control transformers:		-
	1) In case of earthed control circuit supplies, the common conductor is connected to the protective bonding circuit at the point of supply. All contacts, solid state elements etc., which are intended to operate an electromagnetic or other device (for example, a relay, indicator light) are inserted between one side, the switched conductor of the control circuit supply and one terminal of the coil or device. The other terminal of the coil or device (preferably always having the same marking) is connected directly to the common conductor of the control circuit supply without any switching elements (see Figure 3).		N/A
	Exception: Contacts of protective devices may be connected between the common conductor and the coils, provided that:		N/A
	– the circuit is interrupted automatically in the event of an earth fault, or		N/A
	– the connection is very short (for example in the same enclosure) so that an earth fault is unlikely (for example overload relays).		N/A
	2) Control circuits fed from a control transformer and not connected to the protective bonding circuit, having the same arrangement as shown in Figure 3 and provided with a device that interrupts the circuit automatically in the event of an earth fault (see also 7.2.4).		N/A
Method b)	Control circuits fed from a control transformer with a centre-tapped winding, this centre tap connected to the protective bonding circuit, arranged as shown in Figure 4 with the overcurrent protective device having switching elements in all control circuit supply conductors.	Pass muster	P
Method c)	Where the control circuit is not fed from a control transformer and is either:		-
	1) directly connected between the phase conductors of an earthed supply, or;		N/A
	2) directly connected between the phase conductors or between a phase conductor and a neutral conductor of a supply that is not earthed or is earthed through a high impedance,		N/A
	Multi-pole control switches that switch all live conductors are used for START or STOP of those machine functions that can cause a hazardous situation or damage to the machine in the event of unintentional starting or failure to stop, or in the case of c) 2), a device shall be provided that		-

Clause	Requirement - test	Result-Remark	Verdict
	interrupts the circuit automatically in the event of an earth fault.		
9.4.3.2	Voltage interruptions		-
	The requirements detailed in 7.5 shall apply.		-
	Where the control system uses a memory device(s), proper functioning in the event of power failure shall be ensured (for example by using a non-volatile memory) to prevent any loss of memory that can result in a hazardous situation.		N/A
9.4.3.3	Loss of circuit continuity		-
	Where the loss of continuity of safety-related control circuits depending upon sliding contacts can result in a hazardous situation, appropriate measures shall be taken (for example by duplication of the sliding contacts).	Pass muster	P
10	Operator interface and machine-mounted control devices		-
10.1	General		-
10.1.1	General device requirements		-
	This Clause contains requirements for devices mounted outside or partially outside control enclosures.		-
	As far as is practicable, those devices shall be selected, mounted, and identified or coded in accordance with relevant parts of IEC 61310.	Pass muster	P
	The possibility of inadvertent operation shall be minimized by, for example, positioning of devices, suitable design, and provision of additional protective measures. Particular consideration shall be given to the selection, arrangement, programming and use of operator input devices such as touchscreens, keypads and keyboards, for the control of hazardous machine operations. See IEC 60447.	Comply with the requirement	P
10.2	Location and mounting		-
	As far as is practicable, machine-mounted control devices shall be:		-
	– readily accessible for service and maintenance;	Pass muster	P
	– mounted in such a manner as to minimize the possibility of damage from activities such as material handling.	Pass muster	P
	The actuators of hand-operated control devices shall be selected and installed so that:		-
	– they are not less than 0,6 m above the servicing level and are within easy reach of the normal working position of the operator;	Pass muster	P
	– the operator is not placed in a hazardous situation when operating them.	Pass muster	P
	The actuators of foot-operated control devices shall be selected and		N/A

Clause	Requirement - test	Result-Remark	Verdict
	installed so that:		
	– they are within easy reach of the normal working position of the operator;		N/A
	– the operator is not placed in a hazardous situation when operating them.		-
10.1.3	Protection		-
	The degree of protection (see IEC 60529) together with other appropriate measures shall afford protection against:		-
	– the effects of aggressive liquids, vapours, or gases found in the physical environment or used on the machine;		N/A
	– the ingress of contaminants (for example swarf, dust, particulate matter).	Pass muster	P
	In addition, the operator interface control devices shall have a minimum degree of protection against direct contact of IPXXD (see IEC 60529).	Pass muster	P
10.1.4	Position sensors		-
	Position sensors (for example position switches, proximity switches) shall be so arranged that they will not be damaged in the event of overtravel.		N/A
	Position sensors in circuits with safety-related control functions shall have direct opening action (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		N/A
10.1.5	Portable and pendant control stations		-
	Portable and pendant operator control stations and their control devices shall be so selected and arranged as to minimize the possibility of inadvertent machine operations caused by shocks and vibrations (for example if the operator control station is dropped or strikes an obstruction) (see also 4.4.8).		N/A
10.2	Push-buttons		-
10.2.1	Colours		-
	Push-button actuators shall be colour-coded in accordance with Table 2 (see also 9.2 and Annex B).		P
	The colours for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used.	Pass muster	P
	The colour RED shall be used for emergency stop and emergency switching off actuators.		P
	The colours for STOP/OFF actuators should be BLACK, GREY, or	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	WHITE with a preference for BLACK. GREEN shall not be used. RED is permitted, but it is recommended that RED is not used near an emergency operation device.		
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that alternately act as START/ON and STOP/OFF push- buttons. The colours RED, YELLOW, or GREEN shall not be used (see also 9.2.6).	Pass muster	P
	WHITE, GREY, or BLACK are the preferred colours for push-button actuators that cause operation while they are actuated and cease the operation when they are released (for example hold-to-run). The colours RED, YELLOW, or GREEN shall not be used.		N/A
	Reset push-buttons shall be BLUE, WHITE, GREY, or BLACK. Where they also act as a STOP/OFF button, the colours WHITE, GREY, or BLACK are preferred with the main preference being for BLACK. GREEN shall not be used.	Pass muster	P
	Where the same colour WHITE, GREY, or BLACK is used for various functions (for example WHITE for START/ON and for STOP/OFF actuators) a supplementary means of coding (for example shape, position, symbol) shall be used for the identification of push-button actuators.	Pass muster	P
10.2.2	Markings		-
	In addition to the functional identification as described in 16.3, it is recommended that pushbuttons be marked, near to or preferably directly on the actuators, with the symbols given in Table 3.	Comply with the requirement	P
10.3	Indicator lights and displays		-
10.3.1	General		-
	Indicator lights and displays serve to give the following types of information:		-
	– indication: to attract the operator's attention or to indicate that a certain task should be performed. The colours RED, YELLOW, BLUE, and GREEN are normally used in this mode; for flashing indicator lights and displays, see 10.3.3.	Comply with the requirement	P
	– confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colours BLUE and WHITE are normally used in this mode and GREEN may be used in some cases.		N/A
	Indicator lights and displays shall be selected and installed in such a manner as to be visible from the normal position of the operator (see	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	also IEC 61310-1).		
	Indicator light circuits used for warning lights shall be fitted with facilities to check the operability of these lights.	Pass muster	P
10.3.2	Colours		-
	Unless otherwise agreed between the supplier and the user (see Annex B), indicator lights shall be colour-coded with respect to the condition (status) of the machine in accordance with Table 4.	In accordance with Table 4	P
	Indicating towers on machines should have the applicable colours in the following order from the top down; RED, YELLOW, BLUE, GREEN and WHITE.		N/A
10.3.3	Flashing lights and displays		-
	For further distinction or information and especially to give additional emphasis, flashing lights and displays can be provided for the following purposes:		-
	– to attract attention;		P
	– to request immediate action;		P
	– to indicate a discrepancy between the command and actual state;		P
	– to indicate a change in process (flashing during transition).		N/A
	It is recommended that higher frequency flashing lights or display be used for higher priority information (see IEC 60073 for recommended flashing rates and pulse/pause ratios).		N/A
	Where flashing lights or displays are used to provide higher priority information, audible warning devices should also be provided.		N/A
10.4	Illuminated push-buttons		-
	Illuminated push-button actuators shall be colour-coded in accordance with Tables 2 and 4. Where there is difficulty in assigning an appropriate colour, WHITE shall be used. The colour RED for the emergency stop actuator shall not depend on the illumination of its light.		N/A
10.5	Rotary control devices		-
	Devices having a rotational member, such as potentiometers and selector switches, shall have means of prevention of rotation of the stationary member. Friction alone shall not be considered sufficient.		N/A
10.6	Start devices		-
	Actuators used to initiate a start function or the movement of machine elements (for example slides, spindles, carriers) shall be constructed and mounted so as to minimize inadvertent operation. However,	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	mushroom-type actuators may be used for two-hand control (see also ISO 13851).		
10.7	Emergency stop devices		-
10.7.1	Location of emergency stop devices		-
	Devices for emergency stop shall be readily accessible.		P
	Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required (exception: see 9.2.7.3).	Emergency stop devices are located at suitable locations	P
	There can be circumstances where confusion can occur between active and inactive emergency stop devices caused by disabling the operator control station. In such cases, means (for example, information for use) shall be provided to minimise confusion.		N/A
10.7.2	Types of emergency stop device		-
	The types of device for emergency stop include:		-
	– a push-button operated switch with a palm or mushroom head type;		P
	– a pull-cord operated switch;		N/A
	– a pedal-operated switch without a mechanical guard.		N/A
	The devices shall have direct opening operation (see IEC 60947-5-1, Annex K).	Pass muster	P
10.7.3	Colour of actuators		-
	Actuators of emergency stop devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW. See also ISO 13850.	Pass muster	P
10.7.4	Local operation of the supply disconnecting device to effect emergency stop		-
	The supply disconnecting device may be locally operated to serve the function of emergency stop when:		-
	– it is readily accessible to the operator; and		N/A
	– it is of the type described in 5.3.2 a), b), c), or d).		N/A
	When also intended for such use, the supply disconnecting device shall meet the colour requirements of 10.7.3.		N/A
10.8	Emergency switching off devices		-
10.8.1	Location of emergency switching off devices		-
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations. Where it is necessary to provide a control station with an emergency stop device and an emergency		N/A

Clause	Requirement - test	Result-Remark	Verdict
	switching off device, means shall be provided to avoid confusion between these devices.		
10.8.2	Types of emergency switching off device		-
	The types of device for emergency switching off include:		-
	– a push-button operated switch with a palm or mushroom head type of actuator;		N/A
	– a pull-cord operated switch.		N/A
	The devices shall have direct opening action (see IEC 60947-5-1, Annex K).		N/A
	The push-button operated switch may be in a break-glass enclosure.		N/A
10.8.2	Colour of actuators		-
	Actuators of emergency switching off devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW.		N/A
	Where confusion can occur between emergency stop and emergency switching off devices, means shall be provided to minimise confusion.		N/A
10.8.3	Local operation of the supply disconnecting device to effect emergency switching off		-
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and should meet the colour requirements of 10.8.3.		N/A
10.9	Enabling control device		-
	When an enabling control device is provided as a part of a system, it shall signal the enabling control to allow operation when actuated in one position only. In any other position, operation shall be stopped or prevented.		N/A
	Enabling control devices shall be selected and arranged so as to minimize the possibility of defeating.		-
	Enabling control devices shall be selected that have the following features:		N/A
	– designed in accordance with ergonomic principles;		N/A
	– for a two-position type:		N/A
	- position 1: off-function of the switch (actuator is not operated);		N/A
	- position 2: enabling function (actuator is operated).		N/A
	– for a three-position type:		N/A
	- position 1: off-function of the switch (actuator is not operated);		N/A
	- position 2: enabling function (actuator is operated in its mid position);		N/A

Clause	Requirement - test	Result-Remark	Verdict
	- position 3: off-function (actuator is operated past its mid position);		N/A
	- when returning from position 3 to position 2, the enabling function is not activated.		N/A
11	Controlgear: location, mounting, and enclosures		-
11.1	General requirements		-
	All controlgear shall be located and mounted so as to facilitate:		-
	– its accessibility and maintenance;		P
	– its protection against the external influences or conditions under which it is intended to operate;		P
	– operation and maintenance of the machine and its associated equipment.		P
11.2	Location and mounting		-
11.2.1	Accessibility and maintenance		-
	All items of controlgear shall be placed and oriented so that they can be identified without moving them or the wiring. For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers, barriers or obstacles). Terminals not part of controlgear components or devices shall also conform to these requirements.	Comply with the requirement	P
	All controlgear shall be mounted so as to facilitate its operation and maintenance from the front. Where a special tool is necessary to adjust, maintain, or remove a device, such a tool shall be supplied. Where access is required for regular maintenance or adjustment, the relevant devices shall be located between 0,4 m and 2,0 m above the servicing level. It is recommended that terminals be at least 0,2 m above the servicing level and be so placed that conductors and cables can be easily connected to them.	Comply with the requirement	P
	No devices except devices for operating, indicating, measuring, and cooling shall be mounted on doors or on normally removable access covers of enclosures. Where control devices are connected through plug-in arrangements, their association shall be made clear by type (shape), marking or reference designation, singly or in combination (see 13.4.5).	Comply with the requirement	P
	Plug-in devices that are handled during normal operation shall be provided with non-interchangeable features where the lack of such a facility can result in malfunctioning.		N/A
	Plug/socket combinations that are handled during normal operation	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	shall be located and mounted so as to provide unobstructed access.		
	Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access.	Pass muster	P
	Test points for connection of test equipment, where provided, shall be:		-
	– mounted so as to provide unobstructed access;		P
	– clearly identified to correspond with the documentation (see 17.3);		P
	– adequately insulated;		P
	– sufficiently spaced.		P
11.2.2	Physical separation or grouping		-
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing controlgear. Devices such as solenoid valves should be separated from the other electrical equipment (for example in a separate compartment).		N/A
	Control devices mounted in the same location and connected to the supply voltage, or to both supply and control voltages, shall be grouped separately from those connected only to the control voltages.		N/A
	Terminals shall be separated into groups for:		-
	– power circuits;		N/A
	– associated control circuits;		N/A
	– other control circuits, fed from external sources (for example for interlocking).		N/A
	The groups may be mounted adjacently, provided that each group can be readily identified (for example by markings, by use of different sizes, by use of barriers or by colours).		N/A
	When arranging the location of devices (including interconnections), the clearances and creepage distances specified for them by the supplier shall be maintained, taking into account the external influences or conditions of the physical environment.		N/A
11.2.3	Heating effects		-
	Heat generating components (for example heat sinks, power resistors) shall be so located that the temperature of each component in the vicinity remains within the permitted limit.		N/A
11.3	Degrees of protection		-
	The protection of controlgear against ingress of solid foreign objects and of liquids shall be adequate taking into account the external influences under which the machine is intended to operate (i.e. the location and the physical environmental conditions) and shall be		N/A

Clause	Requirement - test	Result-Remark	Verdict
	sufficient against dust, coolants, and swarf.		
	Enclosures of controlgear shall provide a degree of protection of at least IP22 (see IEC 60529).		N/A
	Exceptions:		-
a)	Where an electrical operating area is used as a protective enclosure for an appropriate degree of protection against the ingress of solid bodies and liquids.		N/A
b)	Where removable collectors on conductor wire or conductor bar systems are used and IP22 is not achieved, but the measures of 6.2.5 are applied.		N/A
11.4	Enclosures, doors and openings		-
	Enclosures shall be constructed using materials capable of withstanding the mechanical, electrical and thermal stresses as well as the effects of humidity and other environmental factors that are likely to be encountered in normal service.	Comply with the requirement	P
	Fasteners used to secure doors and covers should be of the captive type. Windows provided for viewing internally mounted indicating devices shall be of a material suitable to withstand mechanical stress and chemical attack (for example toughened glass or polycarbonate sheet of not less than 3 mm thickness).	Toughened glass of not less than 3 mm thickness	P
	It is recommended that enclosure doors be not wider than 0,9 m and have vertical hinges, with an angle of opening of at least 95°.	0,75m and 105°	P
	The joints or gaskets of doors, lids, covers and enclosures shall withstand the chemical effects of the aggressive liquids, vapours, or gases used on the machine. The means provided to maintain the degree of protection of an enclosure on doors, lids and covers that require opening or removal for operation or maintenance shall:		-
	– be securely attached to either the door/cover or the enclosure;		P
	– not deteriorate due to removal or replacement of the door or the cover, and so impair the degree of protection.		P
	Where openings in enclosures are provided (for example, for cable access), including those towards the floor or foundation or to other parts of the machine, means shall be provided to ensure the degree of protection specified for the equipment. Openings for cable entries shall be easily re-opened on site. A suitable opening may be provided in the base of enclosures within the machine so that moisture due to condensation can drain away.	Comply with the requirement	P
	There shall be no opening between enclosures containing electrical	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	equipment and compartments containing coolant, lubricating or hydraulic fluids, or those into which oil, other liquids, or dust can penetrate. This requirement does not apply to electrical devices specifically designed to operate in oil (for example electromagnetic clutches) nor to electrical equipment in which coolants are used.		
	Where there are holes in an enclosure for mounting purposes, means may be necessary to ensure that after mounting, the holes do not impair the required protection.		N/A
	Equipment that, in normal or abnormal operation, can attain a surface temperature sufficient to cause a risk of fire or harmful effect to an enclosure material shall:		-
	– be located within an enclosure that will withstand, without risk of fire or harmful effect, such temperatures as can be generated; and		N/A
	– be mounted and located at a sufficient distance from adjacent equipment so as to allow safe dissipation of heat (see also 11.2.3); or		N/A
	– be otherwise screened by material that can withstand, without risk of fire or harmful effect, the heat emitted by the equipment.		N/A
11.5	Access to controlgear		-
	Doors in gangways and for access to electrical operating areas shall:		-
	– be at least 0,7 m wide and 2,1 m high;		N/A
	– open outwards;		P
	– have a means (for example panic bolts) to allow opening from the inside without the use of a key or tool.		N/A
	Enclosures which readily allow a person to fully enter shall be provided with means to allow escape, for example panic bolts on the inside of doors. Enclosures intended for such access, for example for resetting, adjusting, maintenance, shall have a clear width of at least 0,7 m and a clear height of at least 2,1 m.		N/A
	In cases where:		
	– equipment is likely to be live during access; and		N/A
	– conducting parts are exposed,		N/A
	the clear width shall be at least 1,0 m. In cases where such parts are present on both sides of the access way, the clear width shall be at least 1,5 m.		N/A
12	Conductors and cables		-
12.1	General requirements		-
	Conductors and cables shall be selected so as to be suitable for the	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	operating conditions (for example voltage, current, protection against electric shock, grouping of cables) and external influences (for example ambient temperature, presence of water or corrosive substances, mechanical stresses (including stresses during installation), fire hazards) that can exist.		
	These requirements do not apply to the integral wiring of assemblies, subassemblies, and devices that are manufactured and tested in accordance with their relevant IEC standard (for example IEC 60439-1	Pass muster	P
12.2	Conductors		-
	In general, conductors shall be of copper. Where aluminium conductors are used, the crosssectional area shall be at least 16 mm ² .	20 mm ²	P
	To ensure adequate mechanical strength, the cross-sectional area of conductors should not be less than as shown in Table 5. However, conductors with smaller cross-sectional areas or other constructions than shown in Table 5 may be used in equipment provided adequate mechanical strength is achieved by other means and proper functioning is not impaired.	Comply with the requirement	P
	Class 1 and class 2 conductors are primarily intended for use between rigid, non-moving parts.		N/A
	All conductors that are subject to frequent movement (for example one movement per hour of machine operation) shall have flexible stranding of class 5 or class 6.		N/A
12.3	Insulation		-
	The types of insulation include (but are not limited to):		-
	– polyvinyl chloride (PVC);		P
	– rubber, natural and synthetic;		N/A
	– silicone rubber (SiR);		N/A
	– mineral;		N/A
	– cross-linked polyethylene (XLPE);		N/A
	– ethylene propylene compound (EPR).		N/A
	Where the insulation of conductors and cables (for example PVC) can constitute hazards due to the propagation of a fire or the emission of toxic or corrosive fumes, guidance from the cable supplier should be sought. It is important to give special attention to the integrity of a circuit having a safety-related function.	Comply with the requirement	P
	The insulation of cables and conductors used, shall be suitable for a test voltage:		

Clause	Requirement - test	Result-Remark	Verdict
	– not less than 2 000 V a.c. for a duration of 5 min for operation at voltages higher than 50 V a.c. or 120 V d.c., or	Pass muster	P
	– not less than 500 V a.c. for a duration of 5 min for PELV circuits (see IEC 60364-4-41, class III equipment).		N/A
	The mechanical strength and thickness of the insulation shall be such that the insulation cannot be damaged in operation or during laying, especially for cables pulled into ducts.	Pass muster	P
12.4	Current-carrying capacity in normal service		-
	The current-carrying capacity depends on several factors, for example insulation material, number of conductors in a cable, design (sheath), methods of installation, grouping and ambient temperature.	Pass muster	P
	One typical example of the current-carrying capacities for PVC insulated wiring between enclosures and individual items of equipment under steady-state conditions is given in Table 6.	Pass muster	P
12.5	Conductor and cable voltage drop		-
	The voltage drop from the point of supply to the load shall not exceed 5 % of the nominal voltage under normal operating conditions. In order to conform to this requirement, it can be necessary to use conductors having a larger cross-sectional area than that derived from Table 6.	Comply with the requirement	P
12.6	Flexible cables		-
12.6.1	General		-
	Flexible cables shall have Class 5 or Class 6 conductors.		N/A
	Cables that are subjected to severe duties shall be of adequate construction to protect against:		N/A
	– abrasion due to mechanical handling and dragging across rough surfaces;		N/A
	– kinking due to operation without guides;		N/A
	– stress resulting from guide rollers and forced guiding, being wound and re-wound on cable drums.		N/A
12.6.2	Mechanical rating		-
	The cable handling system of the machine shall be so designed to keep the tensile stress of the conductors as low as is practicable during machine operations. Where copper conductors are used, the tensile stress applied to the conductors shall not exceed 15 N/mm ² of the copper cross-sectional area. Where the demands of the application exceed the tensile stress limit of 15 N/mm ² , cables with special construction features should be used and the allowed maximal tensile stress should be agreed with the cable manufacturer.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	The maximum stress applied to the conductors of flexible cables with material other than copper shall be within the cable manufacturer's specification.		N/A
12.6.3	Current-carrying capacity of cables wound on drums		-
	Cables to be wound on drums shall be selected with conductors having a cross-sectional area such that, when fully wound on the drum and carrying the normal service load, the maximum allowable conductor temperature is not exceeded.		N/A
	For cables of circular cross-sectional area installed on drums, the maximum current-carrying capacity in free air should be derated in accordance with Table 7 (see also Clause 44 of IEC 60621-3).		N/A
12.7	Conductor wires, conductor bars and slip-ring assemblies		-
12.7.1	Protection against direct contact		-
	Conductor wires, conductor bars and slip-ring assemblies shall be installed or enclosed in such a way that, during normal access to the machine, protection against direct contact is achieved by the application of one of the following protective measures:		-
	– protection by partial insulation of live parts, or where this is not practicable;		N/A
	– protection by enclosures or barriers of at least IP2X (see 412.2 of IEC 60364-4-41).	Pass muster	P
	Horizontal top surfaces of barriers or enclosures that are readily accessible shall provide a degree of protection of at least IP4X (see 412.2.2 of IEC 60364-4-41).	IP44	P
	Where the required degree of protection is not achieved, protection by placing live parts out of reach in combination with emergency switching off in accordance with 9.2.5.4.3 shall be applied.		N/A
	Conductor wires and conductor bars shall be so placed and/or protected as to:		-
	– prevent contact, especially for unprotected conductor wires and conductor bars, with conductive items such as the cords of pull-cord switches, strain-relief devices and drive chains;	Pass muster	P
	– prevent damage from a swinging load.		P
12.7.2	Protective conductor circuit		-
	Where conductor wires, conductor bars and slip-ring assemblies are installed as part of the protective bonding circuit, they shall not carry current in normal operation. Therefore, the protective conductor (PE)	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	and the neutral conductor (N) shall each use a separate conductor wire, conductor bar or slip-ring. The continuity of the protective conductor circuit using sliding contacts shall be ensured by taking appropriate measures (for example, duplication of the current collector, continuity monitoring).		
12.7.3	Protective conductor current collectors		-
	Protective conductor current collectors shall have a shape or construction so that they are not interchangeable with the other current collectors. Such current collectors shall be of the sliding contact type.	Pass muster	P
12.7.4	Removable current collectors with a disconnecter function		-
	Removable current collectors having a disconnecter function shall be so designed that the protective conductor circuit is interrupted only after the live conductors have been disconnected, and the continuity of the protective conductor circuit is re-established before any live conductor is reconnected (see also 8.2.4).		N/A
12.7.5	Clearances in air		-
	Clearances between the respective conductors and between adjacent systems, of conductor wires, conductor bars, slip-ring assemblies and their current collectors shall be suitable for at least a rated impulse voltage of an overvoltage category III in accordance with IEC 60664-1.		N/A
12.7.6	Creepage distances		-
	Creepage distances between the respective conductors, between adjacent systems of conductor wires, conductor bars and slip-ring assemblies, and their current collectors shall be suitable for operation in the intended environment, for example open air (IEC 60664-1), inside buildings, protected by enclosures.		N/A
	In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply:		N/A
	– unprotected conductor wires, conductor bars, and slip-ring assemblies shall be equipped with insulators with a minimum creepage distance of 60 mm;		N/A
	– enclosed conductor wires, insulated multipole conductor bars and insulated individual conductor bars shall have a minimum creepage distance of 30 mm.		N/A
	The manufacturer's recommendations shall be followed regarding special measures to prevent a gradual reduction in the insulation values due to unfavourable ambient conditions (for example deposits of conductive dust, chemical attack).		N/A

Clause	Requirement - test	Result-Remark	Verdict
12.7.7	Conductor system sectioning		-
	Where conductor wires or conductor bars are arranged so that they can be divided into isolated sections, suitable design measures shall be employed to prevent the energization of adjacent sections by the current collectors themselves.		N/A
12.7.7	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies		-
	Conductor wires, conductor bars and slip-ring assemblies in power circuits shall be grouped separately from those in control circuits.	Pass muster	P
	Conductor wires, conductor bars and slip-ring assemblies shall be capable of withstanding, without damage; the mechanical forces and thermal effects of short-circuit currents.	Pass muster	P
	Removable covers for conductor wire and conductor bar systems laid underground or underfloor shall be so designed that they cannot be opened by one person without the aid of a tool.		N/A
	Where conductor bars are installed in a common metal enclosure, the individual sections of the enclosure shall be bonded together and connected to a protective bonding conductor at several points depending upon their length. Metal covers of conductor bars laid underground or underfloor shall also be bonded together and connected to a protective bonding conductor.	Comply with the requirement	P
	The protective bonding circuit shall include the covers or cover plates of metal enclosures or underfloor ducts. Where metal hinges form a part of the bonding circuit, their continuity shall be verified (see Clause 18).	Pass muster	P
	Underground and underfloor conductor bar ducts shall have drainage facilities.		N/A
13	Wiring practices		-
13.1	Connections and routing		-
13.1.1	General requirements		-
	All connections, especially those of the protective bonding circuit, shall be secured against accidental loosening.	Pass muster	P
	The means of connection shall be suitable for the cross-sectional areas and nature of the conductors being terminated.	Pass muster	P
	The connection of two or more conductors to one terminal is permitted only in those cases where the terminal is designed for that purpose. However, only one protective conductor shall be connected to one terminal connecting point.	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	Soldered connections shall only be permitted where terminals are provided that are suitable for soldering.		N/A
	Terminals on terminal blocks shall be plainly marked or labelled to correspond with markings on the diagrams.	Terminals is plainly marked	P
	Where an incorrect electrical connection (for example, arising from replacement of devices) can be a source of risk and it is not practicable to reduce the possibility of incorrect connection by design measures, the conductors and/or terminations shall be identified in accordance with 13.2.1.	The conductors and terminations are identified in accordance with 13.2.1.	P
	The installation of flexible conduits and cables shall be such that liquids shall drain away from the fittings.	Pass muster	P
	Means of retaining conductor strands shall be provided when terminating conductors at devices or terminals that are not equipped with this facility. Solder shall not be used for that purpose.		N/A
	Shielded conductors shall be so terminated as to prevent fraying of strands and to permit easy disconnection.		N/A
	Identification tags shall be legible, permanent, and appropriate for the physical environment.	Pass muster	P
	Terminal blocks shall be mounted and wired so that the internal and external wiring does not cross over the terminals (see IEC 60947-7-1).	Pass muster	P
13.1.2	Conductor and cable runs		
	Conductors and cables shall be run from terminal to terminal without splices or joints. Connections using plug/socket combinations with suitable protection against accidental disconnection are not considered to be joints for the purpose of this Subclause.	Comply with the requirement	P
	Exception: Where it is impracticable to provide terminals in a junction box (for example on mobile machines, on machines having long flexible cables; cable connections exceeding a length which is not practical to be supplied by the cable manufacturer on one cable drum; repair of cable due to mechanical stresses during installation and operation), splices or joints may be used.		N/A
	Where it is necessary to connect and disconnect cables and cable assemblies, a sufficient extra length shall be provided for that purpose.		N/A
	The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors.		N/A
	Wherever practicable, the protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.	The protective conductor is placed suitably	P

Clause	Requirement - test	Result-Remark	Verdict
13.1.3	Conductors of different circuits		-
	Conductors of different circuits may be laid side by side, may occupy the same duct (for example conduit, cable trunking system), or may be in the same multiconductor cable provided that the arrangement does not impair the proper functioning of the respective circuits. Where those circuits operate at different voltages, the conductors shall be separated by suitable barriers or shall be insulated for the highest voltage to which any conductor within the same duct can be subjected, for example line to line voltage for unearthed systems and phase to earth voltage for earthed systems.		N/A
13.1.4	Connection between pick-up and pick-up converter of an inductive power supply system		-
	The cable between the pick-up and the pick-up converter as specified by the manufacturer of the inductive power supply shall be:		-
	– as short as practicable;		P
	– adequately protected against mechanical damage.		P
13.2	Identification of conductors		-
13.2.1	General requirements		-
	Each conductor shall be identifiable at each termination in accordance with the technical documentation (see Clause 17).	Conductor is identifiable	P
	It is recommended (for example to facilitate maintenance) that conductors be identified by number, alphanumeric, colour (either solid or with one or more stripes), or a combination of colour and numbers or alphanumeric. When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).	Comply with the requirements	P
13.2.2	Identification of the protective conductor		-
	The protective conductor shall be readily distinguishable by shape, location, marking, or colour. When identification is by colour alone, the bicolour combination GREEN-AND-YELLOW shall be used throughout the length of the conductor. This colour identification is strictly reserved for the protective conductor.	Comply with the requirement	P
	For insulated conductors, the bicolour combination GREEN-AND- YELLOW shall be such that on any 15 mm length, one of the colours covers at least 30 % and not more than 70 % of the surface of the conductor, the other colour covering the remainder of the surface.		N/A
	Where the protective conductor can be easily identified by its shape, position, or construction (for example a braided conductor, uninsulated stranded conductor), or where the insulated conductor is not readily		N/A

Clause	Requirement - test	Result-Remark	Verdict
	accessible, colour coding throughout its length is not necessary but the ends or accessible locations shall be clearly identified by the graphical symbol IEC 60417-5019 (DB:2002-10) or by the bicolour combination GREEN-AND-YELLOW.		
13.2.3	Identification of the neutral conductor		-
	Where a circuit includes a neutral conductor that is identified by colour alone, the colour used for this conductor shall be BLUE. In order to avoid confusion with other colours, it is recommended that an unsaturated blue be used, called here "light blue" (see 3.2.2 of IEC 60446). Where the selected colour is the sole identification of the neutral conductor, that colour shall not be used for identifying any other conductor where confusion is possible.		N/A
	Where identification by colour is used, bare conductors used as neutral conductors shall be either coloured by a stripe, 15 mm to 100 mm wide in each compartment or unit and at each accessible location, or coloured throughout their length.		N/A
13.2.4	Identification by colour		-
	Where colour-coding is used for identification of conductors (other than the protective conductor (see 13.2.2) and the neutral conductor (see 13.2.3)), the following colours may be used:		-
	BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.	Pass muster	P
	BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.	Pass muster	P
	For safety reasons, the colour GREEN or the colour YELLOW should not be used where there is a possibility of confusion with the bicolour combination GREEN-AND-YELLOW (see 13.2.2).	Pass muster	P
	Colour identification using combinations of those colours listed above may be used provided there can be no confusion and that GREEN or YELLOW is not used except in the bicolour combination GREEN-AND-YELLOW.	Comply with the requirement	P
	Where colour-coding is used for identification of conductors, it is recommended that they be colour-coded as follows:		-
	– BLACK: a.c. and d.c. power circuits;		N/A
	– RED: a.c. control circuits;		P
	– BLUE: d.c. control circuits;		N/A

Clause	Requirement - test	Result-Remark	Verdict
	– ORANGE: excepted circuits in accordance with 5.3.5.		N/A
	Exceptions: to the above are permitted where:		-
	– insulation is used that is not available in the colours recommended; or		N/A
	– multiconductor cable is used, but not the bicolour combination GREEN-AND-YELLOW.		N/A
13.3	Wiring inside enclosures		-
	Conductors inside enclosures shall be supported where necessary to keep them in place. Non-metallic ducts shall be permitted only when they are made with a flame-retardant insulating material (see the IEC 60332 series).	Comply with the requirement	P
	It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure (see also 11.2.1). Where that is not practicable and control devices are connected from the rear of the enclosure, access doors or swingout panels shall be provided.	Comply with the requirement	P
	Connections to devices mounted on doors or to other movable parts shall be made using flexible conductors in accordance with 12.2 and 12.6 to allow for the frequent movement of the part. The conductors shall be anchored to the fixed part and to the movable part independently of the electrical connection (see also 8.2.3 and 11.2.1).	Comply with the clauses 8.2.3 and 11.2.1	P
	Conductors and cables that do not run in ducts shall be adequately supported.	Conductors and cables are adequately supported	P
	Terminal blocks or plug/socket combinations shall be used for control wiring that extends beyond the enclosure. For plug/socket combinations, see also 13.4.5 and 13.4.6.		N/A
	Power cables and cables of measuring circuits may be directly connected to the terminals of the devices for which the connections were intended.		N/A
13.4	Wiring outside enclosures		-
13.4.1	General requirements		-
	The means of introduction of cables or ducts with their individual glands, bushings, etc., into an enclosure shall ensure that the degree of protection is not reduced (see 11.3).	Pass muster	P
13.4.2	External ducts		-
	Conductors and their connections external to the electrical equipment enclosure(s) shall be enclosed in suitable ducts (i.e. conduit or cable trunking systems) as described in 13.5 except for suitably protected cables that may be installed without ducts and with or without the use	Comply with the requirement	P

Clause	Requirement - test	Result-Remark	Verdict
	of open cable trays or cable support means. Where devices such as position switches or proximity switches are supplied with a dedicated cable, their cable need not be enclosed in a duct when the cable is suitable for the purpose, sufficiently short, and so located or protected, that the risk of damage is minimized.		
	Fittings used with ducts or multiconductor cable shall be suitable for the physical environment.	Fittings are suitable	P
	Flexible conduit or flexible multiconductor cable shall be used where it is necessary to employ flexible connections to pendant push-button stations. The weight of the pendant stations shall be supported by means other than the flexible conduit or the flexible multiconductor cable, except where the conduit or cable is specifically designed for that purpose.		N/A
13.4.3	Connection to moving elements of the machine		-
	Connections to frequently moving parts shall be made using conductors in accordance with 12.2 and 12.6. Flexible cable and flexible conduit shall be so installed as to avoid excessive flexing and straining, particularly at the fittings.		N/A
	Cables subject to movement shall be supported in such a way that there is no mechanical strain on the connection points nor any sharp flexing. When this is achieved by the provision of a loop, it shall have sufficient length to provide for a bending radius of the cable of at least 10 times the diameter of the cable.		N/A
	Flexible cables of machines shall be so installed or protected as to minimize the possibility of external damage due to factors that include the following cable use or potential abuse:		N/A
	– being run over by the machine itself;		N/A
	– being run over by vehicles or other machines;		N/A
	– coming into contact with the machine structure during movements;		N/A
	– running in and out of cable baskets, or on or off cable drums;		N/A
	– acceleration forces and wind forces on festoon systems or suspended cables;		N/A
	– excessive rubbing by cable collector;		N/A
	– exposure to excessive radiated heat.		N/A
	The cable sheath shall be resistant to the normal wear that can be expected from movement and to the effects of environmental contaminants (for example oil, water, coolants, dust).		N/A
	Where cables subject to movement are close to moving parts,		N/A

Clause	Requirement - test	Result-Remark	Verdict
	precautions shall be taken to maintain a space of at least 25 mm between the moving parts and the cables. Where that distance is not practicable, fixed barriers shall be provided between the cables and the moving parts.		
	The cable handling system shall be so designed that lateral cable angles do not exceed 5°, avoiding torsion in the cable when:		N/A
	– being wound on and off cable drums; and		N/A
	– approaching and leaving cable guidance devices.		N/A
	Measures shall be taken to ensure that at least two turns of flexible cables always remain on a drum.		N/A
	Devices serving to guide and carry a flexible cable shall be so designed that the inner bending radius at all points where the cable is bent is not less than the values given in Table 8, unless otherwise agreed with the cable manufacturer, taking into account the permissible tension and the expected fatigue life.		N/A
	The straight section between two bends shall be at least 20 times the diameter of the cable.		N/A
	Where flexible conduit is adjacent to moving parts, the construction and supporting means shall prevent damage to the flexible conduit under all conditions of operation.		N/A
	Flexible conduit shall not be used for connections subject to rapid or frequent movements except when specifically designed for that purpose.		N/A
13.4.4	Interconnection of devices on the machine		-
	Where several machine-mounted switching devices (for example position sensors, pushbuttons) are connected in series or in parallel, it is recommended that the connections between those devices be made through terminals forming intermediate test points. Such terminals shall be conveniently placed, adequately protected, and shown on the relevant diagrams.		N/A
13.4.5	Plug/socket combinations		-
	Where plug/socket combinations are provided, they shall fulfil one or more of the following requirements as applicable:	Pass muster	P
	Exception: The following requirements do not apply to components or devices inside an enclosure, terminated by fixed plug/socket combinations (no flexible cable), or components connected to a bus system by a plug/socket combination.		-
a)	When installed correctly in accordance with f), plug/socket	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	combinations shall be of such a type as to prevent unintentional contact with live parts at any time, including during insertion or removal of the connectors. The degree of protection shall be at least IPXXB. PELV circuits are excepted from this requirement.		
b)	Have a first make last break protective bonding contact (earthing contact) (see also 6.3, 8.2.4) if used in TN- or TT-systems.		N/A
c)	Plug/socket combinations intended to be connected or disconnected during load conditions shall have sufficient load-breaking capacity. Where the plug/socket combination is rated at 30 A, or greater, it shall be interlocked with a switching device so that the connection and disconnection is possible only when the switching device is in the OFF position.		N/A
d)	Plug/socket combinations that are rated at more than 16 A shall have a retaining means to prevent unintended or accidental disconnection.		N/A
e)	Where an unintended or accidental disconnection of plug/socket combinations can cause a hazardous situation, they shall have a retaining means.		N/A
	The installation of plug/socket combinations shall fulfil the following requirements as applicable:		N/A
f)	The component which remains live after disconnection shall have a degree of protection of at least IP2X or IPXXB, taking into account the required clearance and creepage distances. PELV circuits are excepted from this requirement.		N/A
g)	Metallic housings of plug/socket combinations shall be connected to the protective bonding circuit. PELV circuits are excepted from this requirement.		N/A
h)	Plug/socket combinations intended to carry power loads but not to be disconnected during load conditions shall have a retaining means to prevent unintended or accidental disconnection and shall be clearly marked that they are not intended to be disconnected under load		N/A
i)	Where more than one plug/socket combination is provided in the same electrical equipment, the associated combinations shall be clearly identifiable. It is recommended that mechanical coding be used to prevent incorrect insertion.		N/A
j)	Plug/socket combinations used in control circuits shall fulfil the applicable requirements of IEC 61984. Exception: see item k).		N/A
k)	Plug/socket combinations intended for household and similar general purposes shall not be used for control circuits. In plug/socket		N/A

Clause	Requirement - test	Result-Remark	Verdict
	combinations in accordance with IEC 60309-1, only those contacts shall be used for control circuits which are intended for those purposes.		
	Exception: The requirements of item k) do not apply to control functions using high frequency signals on the power supply.		N/A
13.4.6	Dismantling for shipment		-
	Where it is necessary that wiring be disconnected for shipment, terminals or plug/socket combinations shall be provided at the sectional points. Such terminals shall be suitably enclosed and plug/socket combinations shall be protected from the physical environment during transportation and storage.	Comply with the requirements	P
13.4.7	Additional conductors		-
	Consideration should be given to providing		-
	Consideration should be given to providing additional conductors for maintenance or repair. When spare conductors are provided, they shall be connected to spare terminals or isolated in such a manner as to prevent contact with live parts.		P
13.5	Ducts, connection boxes and other boxes		-
13.5.1	General requirements		-
	Ducts shall provide a degree of protection suitable for the application (see IEC 60529).		P
	All sharp edges, flash, burrs, rough surfaces, or threads with which the insulation of the conductors can come in contact shall be removed from ducts and fittings. Where necessary, additional protection consisting of a flame-retardant, oil-resistant insulating material shall be provided to protect conductor insulation.	Puss muster	P
	Drain holes of 6 mm diameter are permitted in cable trunking systems, connection boxes, and Mother boxes used for wiring purposes that can be subject to accumulations of oil or moisture. In order to prevent confusion of conduits with oil, air, or water piping, it is recommended that the conduits be either physically separated or suitably identified.	Comply with the requirements	P
	Ducts and cable trays shall be rigidly supported and positioned at a sufficient distance from moving parts and in such a manner so as to minimize the possibility of damage or wear. In areas where human Page is required, the ducts and cable trays shall be mounted at least 2 m above the working surface.		N/A
	Ducts shall be provided only for mechanical protection (see 8.2.3 for requirements for connection to the protective bonding circuit).		N/A
	Cable trays that are partially covered should not be considered to be		N/A

Clause	Requirement - test	Result-Remark	Verdict
	ducts or cable trunking systems (see 13.5.6), and the cables used shall be of a type suitable for installation with or without the use of open cable trays or cable support means.		
13.5.2	Percentage fill of ducts		-
	Consideration of the percentage fill of ducts should be based on the straightness and length of the duct and the flexibility of the conductors. It is recommended that the dimensions and arrangement of the ducts be such as to facilitate the insertion of the conductors and cables.	Comply with the requirements	P
13.5.3	Rigid metal conduit and fittings		-
	Rigid metal conduit and fittings shall be of galvanized steel or of a corrosion-resistant material suitable for the conditions. The use of dissimilar metals in contact that can cause galvanic action should be avoided.		N/A
	Conduits shall be securely held in place and supported at each end.		N/A
	Fittings shall be compatible with the conduit and appropriate for the application. Fittings shall be threaded unless structural difficulties prevent assembly. Where threadless fittings are used, the conduit shall be securely fastened to the equipment.		N/A
	Conduit bends shall be made in such a manner that the conduit shall not be damaged and the internal diameter of the conduit shall not be effectively reduced.		N/A
13.5.4	Flexible metal conduit and fittings		-
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour. It shall be suitable for the expected physical environment		N/A
	Fittings shall be compatible with the conduit and appropriate for the application.		N/A
13.5.5	Flexible non-metallic conduit and fittings		-
	Flexible non-metallic conduit shall be resistant to kinking and shall have physical characteristics similar to those of the sheath of multiconductor cables.	Puss muster	P
	The conduit shall be suitable for use in the expected physical environment.	Puss muster	P
	Fittings shall be compatible with the conduit and appropriate for the application.	Puss muster	P
13.5.6	Cable trunking systems		-
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving or contaminating portions of the machine.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	Covers shall be shaped to overlap the sides; gaskets shall be permitted. Covers shall be attached to cable trunking systems by suitable means. On horizontal cable trunking systems, the cover shall not be on the bottom unless specifically designed for such installation.		N/A
	NOTE Requirements for cable trunking and ducting systems for electrical installations are given in the IEC 61084 series.		N/A
	Where the cable trunking system is furnished in sections, the joints between sections shall fit tightly but need not be gasketed.		N/A
	The only openings permitted shall be those required for wiring or for drainage. Cable trunking systems shall not have opened but unused knockouts.		N/A
13.5.7	Machine compartments and cable trunking systems		-
	The use of compartments or cable trunking systems within the column or base of a machine to enclose conductors is permitted provided the compartments or cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed. Conductors run in enclosed compartments and cable trunking systems shall be so secured and arranged that they are not subject to damage.		N/A
13.5.8	Connection boxes and other boxes		-
	Connection boxes and other boxes used for wiring purposes shall be accessible for maintenance. Those boxes shall provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate (see 11.3).	The boxes provide protection against the ingress of solid bodies and liquids	P
	Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flyings, oil, and coolant.	Puss muster	P
13.5.9	Motor connection boxes		-
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices (for example brakes, temperature sensors, plugging switches, tachometer generators).		N/A
14	Electric motors and associated equipment		-
14.1	General requirements		-
	Electric motors should conform to the relevant parts of IEC 60034 series.		N/A
	The protection requirements for motors and associated equipment are given in 7.2 for overcurrent protection, in 7.3 for overload protection, and in 7.6 for overspeed protection.		N/A

Clause	Requirement - test	Result-Remark	Verdict
	As many controllers do not switch off the supply to a motor when it is at rest, care shall be taken to ensure compliance with the requirements of 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4. Motor control equipment shall be located and mounted in accordance with Clause 11.		N/A
14.2	Motor enclosures		-
	It is recommended that motor enclosures be chosen from those included in IEC 60034-5.		N/A
	The degree of protection shall be at least IP23 (see IEC 60529) for all motors. More stringent requirements can be needed depending on the application and the physical environment (see 4.4). Motors incorporated as an integral part of the machine shall be so mounted that they are adequately protected from mechanical damage.		N/A
14.3	Motor dimensions		-
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.		N/A
14.4	Motor mounting and compartments		-
	Each motor and its associated couplings, belts, pulleys, or chains, shall be so mounted that they are adequately protected and are easily accessible for inspection, maintenance, adjustment and alignment, lubrication, and replacement. The motor mounting arrangement shall be such that all motor hold-down means can be removed and all terminal boxes are accessible.		N/A
	Motors shall be so mounted that proper cooling is ensured and the temperature rise remains within the limits of the insulation class (see IEC 60034-1).		N/A
	Where practicable, motor compartments should be clean and dry, and when required, shall be ventilated directly to the exterior of the machine. The vents shall be such that ingress of swarf, dust, or water spray is at an acceptable level.		N/A
	There shall be no opening between the motor compartment and any other compartment that does not meet the motor compartment requirements. Where a conduit or pipe is run into the motor compartment from another compartment not meeting the motor compartment requirements, any clearance around the conduit or pipe shall be sealed.		N/A
14.5	Criteria for motor selection		-
	The characteristics of motors and associated equipment shall be selected in accordance with the anticipated service and physical		-

Clause	Requirement - test	Result-Remark	Verdict
	environmental conditions (see 4.4). In this respect, the points that shall be considered include:		
	type of motor;		N/A
	type of duty cycle (see IEC 60034-1);		N/A
	fixed speed or variable speed operation, (and the consequent variable influence of the ventilation);		-
	mechanical vibration;		N/A
	type of motor control;		N/A
	influence of the harmonic spectrum of the voltage and/or current feeding the motor (particularly when it is supplied from a static converter) on the temperature rise;		N/A
	method of starting and the possible influence of the inrush current on the operation of other users of the same power supply, taking also into account possible special considerations stipulated by the supply authority;		N/A
	variation of counter-torque load with time and speed;		N/A
	influence of loads with large inertia;		N/A
	influence of constant torque or constant power operation;		N/A
	possible need of inductive reactors between motor and converter.		N/A
14.6	Protective devices for mechanical brakes		-
	Operation of the overload and overcurrent protective devices for mechanical brake actuators shall initiate the simultaneous deenergization (release) of the associated machine actuators.		N/A
	NOTE: Associated machine actuators are those associated with the same motion, for example cable drums and long-travel drives.		N/A
15	Accessories and lighting		-
15.1	Accessories		-
	Where the machine or its associated equipment is provided with socket-outlets that are intended to be used for accessory equipment (for example hand-held power tools, test equipment), the following apply:		N/A
	the socket-outlets should conform to IEC 60309-1. Where that is not practicable, they should be clearly marked with the voltage and current ratings;		N/A
	the continuity of the protective bonding circuit to the socket-outlet shall be ensured except where protection is provided by PELV;		N/A
	all unearthed conductors connected to the socket-outlet shall be protected against overcurrent and, when required, against overload in		N/A

Clause	Requirement - test	Result-Remark	Verdict
	accordance with 7.2 and 7.3 separately from the protection of other circuits;		
	where the power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply.		N/A
	NOTE 1 See also Annex B.		N/A
	NOTE 2 Circuits for socket-outlets can be provided with residual current protective devices (RCDs).		N/A
15.2	Local lighting of the machine and equipment		-
15.2.1	General		-
	Connections to the protective bonding circuit shall be in accordance with 8.2.2.		N/A
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords.		N/A
	Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaires.		N/A
	Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.		N/A
15.2.2	Supply		-
	The nominal voltage of the local lighting circuit shall not exceed 250 V between conductors. A voltage not exceeding 50 V between conductors is recommended.		N/A
	Lighting circuits shall be supplied from one of the following sources (see also 7.2.6):		N/A
	a dedicated isolating transformer connected to the load side of the supply disconnecting device. Overcurrent protection shall be provided in the secondary circuit;		N/A
	a dedicated isolating transformer connected to the line side of the supply disconnecting device. That source shall be permitted for maintenance lighting circuits in control enclosures only. Overcurrent protection shall be provided in the secondary circuit (see also 5.3.5 and 13.1.3);		N/A
	a machine circuit with dedicated overcurrent protection;		N/A
	an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means (see 5.3.5) and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device		N/A

Clause	Requirement - test	Result-Remark	Verdict
	(see also 13.1.3);		
	an externally supplied lighting circuit (for example factory lighting supply). This shall be permitted in control enclosures only, and for the machine work light(s) where their total power rating is not more than 3 kW.		N/A
	Exception: where fixed lighting is out of reach of operators during normal operations, the provisions of this Subclause do not apply.		N/A
15.2.3	Protection		-
	Local lighting circuits shall be protected in accordance with 7.2.6.		N/A
15.2.4	Fittings		-
	Adjustable lighting fittings shall be suitable for the physical environment.		N/A
	The lampholders shall be:		-
	in accordance with the relevant IEC standard;		N/A
	constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact.		N/A
	Reflectors shall be supported by a bracket and not by the lampholder.		N/A
	Exception: where fixed lighting is out of reach of operators during normal operation, the provisions of this Subclause do not apply.		N/A
16	Marking, warning signs and reference designations		-
16.1	General		-
	Warning signs, nameplates, markings, and identification plates shall be of sufficient durability to withstand the physical environment involved.	Pass muster	P
16.2	Warning signs		-
16.2.1	Electric shock hazard		-
	Enclosures that do not otherwise clearly show that they contain electrical equipment that can give rise to a risk of electric shock shall be marked with the graphical symbol IEC 60417-5036 (DB:2002-10).	Pass muster	P
	The warning sign shall be plainly visible on the enclosure door or cover.	Pass muster	P
	The warning sign may be omitted (see also 6.2.2 b)) for:		-
	an enclosure equipped with a supply disconnecting device;		N/A
	an operator-machine interface or control station;		N/A
	a single device with its own enclosure (for example position sensor).		N/A
16.2.2	Hot surfaces hazard		-
	Where the risk assessment shows the need to warn against the possibility of hazardous surface temperatures of the electrical		N/A

Clause	Requirement - test	Result-Remark	Verdict
	equipment, the graphical symbol IEC 60417-5041 (DB:2002-10) shall be used.		
	NOTE For electrical installations, this measure is dealt with in IEC 60364-4-42, Clause 423 and Table 42A.		-
16.3	Functional identification		-
	Control devices, visual indicators, and displays (particularly those related to safety) shall be clearly and durably marked with regard to their functions either on or adjacent to the item. Such markings may be as agreed between the user and the supplier of the equipment (see Annex B). Preference should be given to the use of standard symbols given in IEC 60417- DB:2002 and ISO 7000.	Comply with the requirements	P
16.4	Marking of equipment		-
	Equipment (for example controlgear assemblies) shall be legibly and durably marked in a way that is plainly visible after the equipment is installed. A nameplate giving the following information shall be attached to the enclosure adjacent to each incoming supply:	Comply with the requirements	P
	name or trade mark of supplier;		P
	certification mark, when required;		N/A
	serial number, where applicable;		P
	rated voltage, number of phases and frequency (if a.c.), and full-load current for each supply;		P
	short-circuit rating of the equipment;		N/A
	main document number (see IEC 62023).		N/A
	The full-load current shown on the nameplate shall be not less than the running currents for all motors and other equipment that can be in operation at the same time under normal conditions	Pass muster	P
	Where only a single motor controller is used, that information may instead be provided on the machine nameplate where it is plainly visible.	Pass muster	P
16.5	Reference designations		-
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation.	Pass muster	P
17	Technical documentation		-
17.1	General		-
	The information necessary for installation, operation, and maintenance of the electrical equipment of a machine shall be supplied in the	Information supplied in the appropriate forms	P

Clause	Requirement - test	Result-Remark	Verdict
	appropriate forms, for example, drawings, diagrams, charts, tables, instructions. The information shall be in an agreed language (see also Annex B). The information provided may vary with the complexity of the electrical equipment. For very simple equipment, the relevant information may be contained in one document, provided that the document shows all the devices of the electrical equipment and enables the connections to the supply network to be made.		
	NOTE 1 The technical documentation provided with items of electrical equipment can form part of the documentation of the electrical equipment of the machine.		-
	NOTE 2 In some countries, the requirement to use specific language(s) is covered by legal requirements.		-
17.2	Information to be provided		-
	The information provided with the electrical equipment shall include:		-
a)	A main document (parts list or list of documents);		P
b)	Complementary documents including:		-
1)	a clear, comprehensive description of the equipment, installation and mounting, and the connection to the electrical supply(ies);		P
2)	electrical supply(ies) requirements;		P
3)	information on the physical environment (for example lighting, vibration, atmospheric contaminants) where appropriate;		N/A
4)	overview (block) diagram(s) where appropriate;		P
5)	circuit diagram(s);		P
6)	information (as applicable) on:		-
	programming, as necessary for use of the equipment;		N/A
	sequence of operation(s);		P
	frequency of inspection;		P
	frequency and method of functional testing;		N/A
	guidance on the adjustment, maintenance, and repair, particularly of the protective devices and circuits;		P
	recommended spare parts list; and list of tools supplied.		N/A
7)	a description (including interconnection diagrams) of the safeguards, interlocking functions, and interlocking of guards against hazards, particularly for machines operating in a co-ordinated manner;		N/A
8)	a description of the safeguarding and of the means provided where it is necessary to suspend the safeguarding (for example for setting or		N/A

Clause	Requirement - test	Result-Remark	Verdict
	maintenance), (see 9.2.4);		
9)	instructions on the procedures for securing the machine for safe maintenance; (see also 17.8);		P
10)	information on handling, transportation and storage;		P
11)	information regarding load currents, peak starting currents and permitted voltage drops, as applicable;		N/A
12)	information on the residual risks due to the protection measures adopted, indication of whether any particular training is required and specification of any necessary personal protective equipment.		N/A
17.3	Requirements applicable to all documentation		-
	Unless otherwise agreed between manufacturer and user:		-
	the documentation shall be in accordance with relevant parts of IEC 61082;	Accord to IEC 61082	P
	reference designations shall be in accordance with relevant parts of IEC 61346;	Accord to IEC 61346	P
	Instructions/manuals shall be in accordance with IEC 62079.	Accord to IEC 62079	P
	parts lists where provided shall be in accordance with IEC 62027, class B.	Accord to IEC 62027	P
	NOTE See item 13 of Annex B.		-
	For referencing of the different documents, the supplier shall select one of the following methods:		-
	where the documentation consists of a small number of documents (for example less than 5) each of the documents shall carry as a cross- reference the document numbers of all other documents belonging to the electrical equipment; or	The documentation has a reference number	P
	for single level main documents only (see IEC 62023), all documents shall be listed with document numbers and titles in a drawing or document list; or		N/A
	all documents of a certain level (see IEC 62023) of the document structure shall be listed, with document numbers and titles, in a parts list belonging to the same level.		N/A
17.4	Installation documents		-
	The installation documents shall give all information necessary for the preliminary work of setting up the machine (including commissioning). In complex cases, it may be necessary to refer to the assembly drawings for details.	The installation documents meet the requirements	P
	The recommended position, type, and cross-sectional areas of the		P

Clause	Requirement - test	Result-Remark	Verdict
	supply cables to be installed on site shall be clearly indicated.		
	The data necessary for choosing the type, characteristics, rated currents, and setting of the overcurrent protective device(s) for the supply conductors to the electrical equipment of the machine shall be stated (see 7.2.2).		N/A
	Where necessary, the size, purpose, and location of any ducts in the foundation that are to be provided by the user shall be detailed (see Annex B).		N/A
	The size, type, and purpose of ducts, cable trays, or cable supports between the machine and the associated equipment that are to be provided by the user shall be detailed (see Annex B).		N/A
	Where necessary, the diagram shall indicate where space is required for the removal or servicing of the electrical equipment.	The diagram meet the requirements	P
	In addition, where it is appropriate, an interconnection diagram or table shall be provided. That diagram or table shall give full information about all external connections. Where the electrical equipment is intended to be operated from more than one source of electrical supply, the interconnection diagram or table shall indicate the modifications or interconnections required for the use of each supply.	Interconnection table is provided	P
17.5	Overview diagrams and function diagrams		-
	Where it is necessary to facilitate the understanding of the principles of operation, an overview diagram shall be provided. An overview diagram symbolically represents the electrical equipment together with its functional interrelationships without necessarily showing all of the interconnections.	Overview diagram is provided	P
	Function diagrams may be provided as either part of, or in addition to, the overview diagram.		N/A
17.6	Circuit diagrams		-
	A circuit diagram(s) shall be provided. This diagram(s) shall show the electrical circuits on the machine and its associated electrical equipment. Any graphical symbol not shown in IEC 60617-DB:2001 shall be separately shown and described on the diagrams or supporting documents. The symbols and identification of components and devices shall be consistent throughout all documents and on the machine.	A right circuit diagram is provided	P
	Where appropriate, a diagram showing the terminals for interface connections shall be provided. That diagram may be used in conjunction with the circuit diagram(s) for simplification. The diagram should contain a reference to the detailed circuit diagram of each	Pass muster	P

Clause	Requirement - test	Result-Remark	Verdict
	unit shown.		
	Switch symbols shall be shown on the electromechanical diagrams with all supplies turned off (for example electricity, air, water, lubricant) and with the machine and its electrical equipment ready for a normal start.	Switch symbols are shown on the electromechanical diagrams	P
	Conductors shall be identified in accordance with 13.2.	Pass muster	P
	Circuits shall be shown in such a way as to facilitate the understanding of their function as well as maintenance and fault location. Characteristics relating to the function of the control devices and components which are not evident from their symbolic representation shall be included on the diagrams adjacent to the symbol or referenced to a footnote.	Circuits are shown in suitable way	P
17.7	Operating manual		-
	The technical documentation shall contain an operating manual detailing proper procedures for set-up and use of the electrical equipment. Particular attention should be given to the safety measures provided.	Comply with the requirements	P
	Where the operation of the equipment can be programmed, detailed information on methods of programming, equipment required, program verification, and additional safety procedures (where required) shall be provided.		N/A
17.8	Maintenance manual		-
	The technical documentation shall contain a maintenance manual detailing proper procedures for adjustment, servicing and preventive inspection, and repair. Recommendations on maintenance/service intervals and records should be part of that manual. Where methods for the verification of proper operation are provided (for example software testing programs), the use of those methods shall be detailed.	Comply with the requirements	P
17.9	Parts list		-
	The parts list, where provided, shall comprise, as a minimum, information necessary for ordering spare or replacement parts (for example components, devices, software, test equipment, technical documentation) required for preventive or corrective maintenance including those that are recommended to be carried in stock by the user of the equipment.	Comply with the requirements	P
18	Verification		-
18.1	General		-
	This part of IEC 60204 gives general requirements for the electrical equipment of machines.		-

Clause	Requirement - test	Result-Remark	Verdict
	The extent of verification will be given in the dedicated product standard for a particular machine. Where there is no dedicated product standard for the machine, the verifications shall always include the items a), b) and f) and may include one or more of the items c) to e):		
a)	verification that the electrical equipment complies with its technical documentation;		N/A
b)	in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2;		N/A
c)	insulation resistance test (see 18.3);		P
d)	voltage test (see 18.4);		P
e)	protection against residual voltage (see 18.5);		P
f)	functional tests (see 18.6).		P
	When these tests are performed, it is recommended that they follow the sequence listed above.		P
	When the electrical equipment is modified, the requirements stated in 18.7 shall apply.	Comply with the requirements stated in 18.7	P
	For tests in accordance with 18.2 and 18.3, measuring equipment in accordance with the EN 61557 series is applicable.	In accordance with 18.2 and 18.3	P
	The results of the verification shall be documented.		P
18.2	Verification of conditions for protection by automatic disconnection of supply		-
18.2.1	General		-
	The conditions for automatic disconnection of supply (see 6.3.3) shall be verified by tests.		N/A
	For TN-systems, those test methods are described in 18.2.2; their applications for different conditions of supply are specified in 18.2.3.		N/A
	For TT and IT systems, see IEC 60364-6-61.		N/A
18.2.2	Test methods in TN-systems		-
	Test 1 verifies the continuity of the protective bonding circuit. Test 2 verifies the conditions for protection by automatic disconnection of the supply.		N/A
	Test 1 – Verification of the continuity of the protective bonding circuit		N/A
	The resistance of each protective bonding circuit between the PE terminal (see 5.2 and Figure 3) and relevant points that are part of each protective bonding circuit shall be measured with a current between at		N/A

Clause	Requirement - test	Result-Remark	Verdict
	least 0,2 A and approximately 10 A derived from an electrically separated supply source (for example SELV, see 413.1 of IEC 60364-4-41) having a maximum no-load voltage of 24 V a.c. or d.c.. It is recommended not to use a PELV supply since such supplies can produce misleading results in this test. The resistance measured shall be in the expected range according to the length, the cross sectional area and the material of the related protective bonding conductor(s).		
	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device		N/A
	The connections of the power supply and of the incoming external protective conductor to the PE terminal of the machine, shall be verified by inspection.		N/A
	The conditions for the protection by automatic disconnection of supply in accordance with 6.3.3 and Annex A shall be verified by both:		N/A
1)	verification of the fault loop impedance by:		N/A
	calculation, or		N/A
	measurement in accordance with A.4, and		N/A
2)	confirmation that the setting and characteristics of the associated overcurrent protective device are in accordance with the requirements of Annex A.		N/A
18.2.3	Application of the test methods for TN-systems		-
	Test 1 of 18.2.2 shall be carried out on each protective bonding circuit of a machine.		N/A
	When Test 2 of 18.2.2 is carried out by measurement, it shall always be preceded by Test 1.		N/A
	The tests that are necessary for machines of different status are specified in Table 9. Table 10 can be used to enable determination of the machine status.		N/A
18.3	Insulation resistance tests		-
	When insulation resistance tests are performed, the insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit shall be not less made on individual sections of the complete electrical installation.	Comply with the requirements	P
	Exception: for certain parts of electrical equipment, incorporating for example busbars, conductor wire or conductor bar systems or slip-ring assemblies, a lower minimum value is permitted, but that value shall not be less than 50K		N/A
	If the electrical equipment of the machine contains surge protection devices which are likely to operate during the test, it is permitted to either:		-

Clause	Requirement - test	Result-Remark	Verdict
	disconnect these devices, or		P
	reduce the test voltage to a value lower than the voltage protection level of the surge protection devices, but not lower than the peak value of the upper limit of the supply (phase to neutral) voltage.		N/A
18.4	Voltage tests		-
	When voltage tests are performed, test equipment in accordance with IEC 61180-2 should be used.	Pass muster	P
	The test voltage shall be at a nominal frequency of 50 Hz or 60 Hz.		P
	The maximum test voltage shall have a value of twice the rated supply voltage of the equipment or 1 000 V, whichever is the greater. The maximum test voltage shall be applied between the power circuit conductors and the protective bonding circuit for a period of approximately 1 s. The requirements are satisfied if no disruptive discharge occurs.	No disruptive discharge occurs	P
	Components and devices that are not rated to withstand the test voltage shall be disconnected during testing.	Pass muster	P
	Components and devices that have been voltage tested in accordance with their product standards may be disconnected during testing.	Pass muster	P
18.5	Protection against residual voltages		
	Where appropriate, tests shall be performed to ensure compliance with 6.2.4.		N/A
18.6	Functional tests		-
	The functions of electrical equipment shall be tested.	Pass muster	P
	The function of circuits for electrical safety (for example earth fault detection) shall be tested.	Pass muster	P
18.7	Retesting		-
	Where a portion of the machine and its associated equipment is changed or modified, that portion shall be reverified and retested, as appropriate (see 18.1).		N/A
	Particular attention should be given to the possible adverse effects that retesting can have on the equipment (for example overstressing of insulation, disconnection/reconnection of devices).		N/A

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4	Test apparatus		-
4.1	Adjustable test plane, a flat, rigid plane having an adjustable slope, with a coefficient of friction as specified in ISO 7176-13:1989, of sufficient size to accommodate the wheelchair during the tests specified in 8.1 and 10.2, and such that the whole surface lies between two imaginary parallel planes 5 mm apart per 1 000 mm of extension in any direction and 50 mm apart per 6 000 mm of extension in any direction.		P
4.2	Horizontal test plane, a flat, rigid plane with a coefficient of friction as specified in ISO 7176-13:1989, of sufficient size to accommodate the wheelchair under test, and such that the whole surface lies between two imaginary horizontal planes 5 mm apart per 1 000 mm of extension in any direction and 50 mm apart per 6 000 mm of extension in any direction.		P
4.3	Means to apply a force between 25 N and 200 N with an accuracy of $\pm 5\%$ and with a rate of application less than 5 N/s.		P
4.4	Means to measure force with an accuracy of $\pm 5\%$ in increments of 1 N in the range of 0 N to 200 N.		
4.5	Means to measure speed between 0 km/h and 20 km/h to an accuracy of $\pm 5\%$.		P
4.6	Means to measure distance in the range of 0 m to 5 m with an accuracy of ± 1 mm or $\pm 2\%$, whichever is the greater.		P
	all parameters (e.g. operating temperature, operating pressure) determined by a given application and pumped liquid		P
4.7	Supplementary weights to add to a human test occupant to achieve the maximum occupant mass specified by the manufacturer and to achieve a similar mass distribution to the dummy specified in 4.9.		P
4.8	Test block, capable of supporting the loaded wheelchair under each of its wheels, with length and width 200 mm ± 10 mm, thickness given in Table 1 'ground unevenness' and corner radii greater than 2,0 mm. For the two large surfaces, the whole of each surface shall lie between two imaginary horizontal planes 1 mm apart. The coefficient of friction shall be as specified in ISO 7176-13:1989.		P
4.9	Test dummy, of appropriate mass, as specified in ISO		

	7176-11:2012.		
4.10	Means to measure torque with an accuracy of $\pm 2\%$ in the range of 0,5 Nm to 10 Nm.		P
4.11	Means to measure angles to an accuracy of $\pm 0,1^\circ$.		P
4.12	Means to move a brake lever smoothly for 60 000 cycles at a frequency of not more than 0,5 Hz.		P
4.13	Means to measure elapsed time in the range 0 s to 30 s with an accuracy of ± 1 s.		P
5	Type classes		
	Wheelchairs shall be classified in one or more of the following three classes, dependent upon their intended use: — Class A: compact, manoeuvrable wheelchairs not necessarily capable of negotiating outdoor obstacles; — Class B: wheelchairs sufficiently compact and manoeuvrable for some indoor environments and capable of negotiating some outdoor obstacles; — Class C: wheelchairs, usually large in size, not necessarily intended for indoor use but capable of travelling over longer distances and negotiating outdoor obstacles.		P
6	General requirements		
	The wheelchair shall conform to the requirements specified in EN 12182 for the following: — intended performance and technical documentation; — aids that can be dismantled; — single-use fasteners; — biocompatibility and toxicity; — contaminants and residues; — infection and microbiological contamination; — overflow, spillage, leakage and ingress of liquids; — safety of moving parts; — prevention of traps for parts of human body; — surfaces, corners and edges; — clinical evaluation; — ergonomics. A risk analysis shall also be carried out in accordance with EN ISO 14971:2012.		P
7	Preparation for testing		P
7.1	General		
	Unless otherwise specified in Clauses 8, 9, 10, 11 and 12, the wheelchair shall be prepared for testing as specified in ISO 7176-22:2000 with the following modification. If a test procedure requires the use of a test dummy or human test occupant, they shall be selected and fitted as specified in 7.2 or 7.3.		P
7.2	Test dummy		
	Select a test dummy, as specified in ISO 7176-11:2012, of mass equal to the maximum occupant mass specified by the wheelchair manufacturer, with a tolerance of 0 kg to +5 kg. Fit the test dummy in the wheelchair as specified in		P

	ISO 7176-22:2000.		
7.3	Human test occupant		
	Select a human test occupant whose mass, in combination with any supplementary weights as specified in 4.7, is equal to the maximum occupant mass specified by the wheelchair manufacturer, with a tolerance of 0 kg to + 5 kg. Seat the occupant in the wheelchair and position and secure the supplementary weights to give substantially the same mass distribution as the test dummy when fitted as specified in ISO 7176-22:2000. WARNING – This testing is potentially hazardous to a human test occupant and other test personnel. Appropriate safety precautions should be taken to avoid injury.		P
8	Wheelchair performance		
8.1	Performance of driving characteristics		
8.1.1	General		
	The loaded wheelchair shall meet the driving performance requirements specified in Table 1 and Table 2 for the type class of the wheelchair as specified in Clause 5.		P
8.1.2	Ability to climb rated slope		
8.1.2.1	Requirements		
	The wheelchair shall be capable of climbing at a speed not less than 2 km/h: — the applicable rated slope for the type class of wheelchair specified in Table 1, or — the rated slope specified by the manufacturer, whichever is greater. The wheelchair passes the test specified in 8.1.2.2 if it achieves or exceeds a speed of 2 km/h after travelling 5 m up the slope.		P
8.1.2.2	Test		
	Adjust the gradient of the adjustable test plane specified in 4.1 to the required angle, $\pm 0,5^\circ$. Starting on the adjustable test plane, drive the loaded wheelchair up the adjustable test plane using the maximum speed command. Use the means to measure speed specified in 4.5. When the wheelchair has travelled $(5,0 \pm 0,1)$ m up the slope, measure and record the speed to an accuracy of $\pm 10\%$.		P
8.1.3	Ground unevenness		
8.1.3.1	Principle		
	It is important that a wheelchair is able to drive on uneven terrain without stopping even if one wheel is at a higher level than the others.		P
8.1.3.2	Requirement		

	The wheelchair shall be capable of driving when any of its wheels is raised to a height specified in Table 1 for ground unevenness.		P
8.1.3.3	Test		
	a) Place the loaded wheelchair on the horizontal test plane. b) Place the test block specified in 4.8 under one wheel, such that one of its largest faces is flat on the test plane with the centre of the block beneath the point of contact with the wheel. c) Attempt to drive the loaded wheelchair off the test block. d) Record the result of the test. e) Repeat for the remaining wheels, one at a time. f) The test is passed if the wheelchair is able to drive off the test block for each wheel.		P
8.1.4	Maximum downhill speed		
8.1.4.1	Requirement		
	The wheelchair shall not exceed 125 % of its maximum speed on the horizontal, when driving down — the applicable rated slope for the type class of wheelchair specified in Table 1, or — the rated slope specified by the manufacturer, whichever is greater.		P
8.1.4.2	Test		
	a) Drive the loaded wheelchair at maximum speed down a gradient with the required slope, 20,5? b) Measure the speed achieved using the means specified in 4.5. c) Record the measured speed and record whether the wheelchair has met the requirement.		P
8.1.5	Dynamic stability		
8.1.5.1	Requirements		
	The dynamic response score of the wheelchair shall be 2 or 3 as specified in Table A.1 of ISO 7176-2:2001 when tested on — the applicable rated slope for the type class of wheelchair specified in Table 1, and — the rated slope specified by the manufacturer.		P
8.1.5.2	Test		
	a) Load the wheelchair with the test dummy in accordance with 7.2. Do not use a human test occupant. b) Test the loaded wheelchair in accordance with ISO 7176-2:2001 with the following modifications: 1) for tests on slopes the test plane is inclined relative to the horizontal at the angle stated in Table 1 for the type class of the wheelchair; 2) fixed test ramps or adjustable test ramps may be used; 3) the test environment specified in Annex F may be used when testing wheelchairs with a maximum speed of 10 km/h or greater, on slopes of 10° or steeper; 4) if the		P

	manufacturer recommends a technique for driving on a slope, test the wheelchair using only the recommended technique; if not, the test methods are unmodified; 5) apply only the clauses listed below: i) for rearwards dynamic stability:		
	I) 8.1 Wheelchair preparation; II) 8.2 Starting forwards; III) 8.3 Stopping after travelling forwards (horizontal only); IV) 8.4 Braking when travelling backwards; ii) for forward dynamic stability: I) 9.1 Wheelchair preparation; II) 9.2 Braking when travelling forwards; iii) for dynamic stability in lateral directions: I) 10.1 Wheelchair preparation; II) 10.2 Turning on a slope (does not apply to manually steered wheelchairs).		P
8.1.6	Obstacle climbing and descending		
8.1.6.1	Requirements		
	The wheelchair shall be capable of climbing and descending obstacles of the height specified in Table 1 for the type class of the wheelchair without any part of the wheelchair other than wheels or a kerb climbing device contacting the obstacle or the test plane.		P
8.1.6.2	Test		
	Put the wheelchair into the least-stable configuration specified by the manufacturer. If the manufacturer does not specify some or all settings for the least-stable configuration, use settings within the range of adjustment specified in the manufacturer's instructions for use to achieve the least-stable configuration. Test the wheelchair as specified in ISO 7176-10:2008 for climbing and descending a test obstacle of the height specified in Table 1 for the type class of the wheelchair. If the manufacturer specifies a method for climbing and descending steps, kerbs or obstacles, test as specified in ISO 7176-10:2008 using only the manufacturer's method. If the manufacturer specifies a run-up distance greater than that specified in ISO 7176-10:2008, limit the run-up distance to the maximum specified in that document. If the manufacturer of the wheelchair does not specify a method for climbing and descending steps, kerbs or obstacles, test as specified in ISO 7176-10:2008 using the methods specified in that document.		P
8.1.7	Static stability		
8.1.7.1	Requirements		
	The wheelchair shall meet or exceed the minimum requirements for static stability specified in Table 1 for the		P

	type class of the wheelchair.		
8.1.7.2	Test		
	Test the loaded wheelchair in the least-stable configuration for each direction as specified in ISO 7176-1:1999 to determine whether it meets or exceeds the angles in Table 1 for the type class of the wheelchair.		P
8.1.8	Maximum speed		
8.1.8.1	Requirements		
	The maximum speed of the wheelchair when travelling forwards and travelling in reverse on the horizontal shall not exceed the maximum speed requirements specified in Table 1 for the type class of the wheelchair.		P
8.1.8.2	Test		
	Test the loaded wheelchair as specified in ISO 7176-6:2001 for the maximum forward speed and maximum reverse speed on a horizontal surface. Record the results and determine whether the requirement has been met.		P
8.2	Static, impact and fatigue strength		
8.2.1	Requirements		
	The wheelchair shall conform to the requirements of ISO 7176-8:1998 with the exception that wheelchairs of Class A are not required to be tested as specified in ISO 7176-8:1998, 10.5, drop test. Arm supports shall conform to the static loading requirements of ISO 7176-8:1998 in all intended operating positions. For wheelchairs with a maximum occupant mass greater than 75 kg but not greater than 100 kg, the maximum upward force to be applied to each single push handle shall be (880 ± 26) N.		P
8.2.2	Test		
	Test the wheelchair in accordance with ISO 7176-8:1998 with modifications as specified in 8.2.1.		P
8.3	Wheelchairs for use as seats in motor vehicles		
	If the manufacturer specifies that the intended use of the wheelchair includes use as a seat in a motor vehicle by an occupant of mass 22 kg or greater, the wheelchair shall conform to the performance requirements of ISO 7176-19:2008 with the following modifications. — 4.1.2 is replaced by the following: If a wheelchair is intended by the manufacturer to also be secured by a docking securement device in public transportation and/or different private vehicles, the securement points on the wheelchair and/or of the wheelchair tiedown adaptors shall conform to the performance requirements in Clause		P

	5. — 5.2.1 a) is replaced by the following: If the wheelchair has a head restraint, the horizontal excursions of the ATD and the wheelchair, with respect to the impact sled, shall not exceed the limits in Table 7 at any time during the test. If the wheelchair does not have a head restraint, the horizontal excursions of the ATD and the wheelchair, with respect to the impact sled, shall not exceed the limits in Table 7 at any time during the test with the exception that the excursion of the back of the head of the ATD, Xhead, R, shall not be measured.		
8.4	Climatic performance		
	The wheelchair shall conform to the requirements of ISO 7176-9:2009.		P
9	Component properties		
9.1	Foot supports, lower leg support assemblies and arm supports		P
9.1.1	Requirements		
	The wheelchair shall be fitted with foot supports that have a means of positioning the occupant's feet at the required height and prevent the occupant's feet from sliding backwards. Any swing away, movable or removable foot support, lower leg support assembly or arm support fitted on the wheelchair shall: a) incorporate a means to locate it securely in any intended operating position, b) be adjustable in increments not exceeding 25 mm, c) be accessible and operable by the occupant or an assistant or both in accordance with the manufacturer's intended use of the wheelchair, d) be within the reach space shown in Figure 1, and e) be operable without the use of tools.		P
9.1.2	Test methods		
9.1.2.1	Test for general performance		
	Fit foot supports, lower leg support assemblies and arm supports in the operating position(s) specified in the manufacturer's instructions. b) Adjust the foot supports, lower leg support assemblies and arm supports as specified in the manufacturer's instructions. c) Record whether the foot supports, lower leg support assemblies and arm supports have met the requirements.		P
9.1.2.2	Test for foot support gap		
	a) Simultaneously apply a force $F \geq 50N$ to the centroid of each foot support, normal to the plane of the unloaded foot support. In cases where the foot support has no identifiable plane, apply the force within 5° of vertical. The force F is calculated from the following equation: $F =$		P

	<p>$0,125 \times m \times g$ where F is the force applied to each foot support, expressed in newtons; m is the maximum occupant mass specified by the manufacturer, expressed in kilograms; g is the acceleration due to gravity, 9,81 m/s²</p> <p>b) Apply the force for 5 s to 10 s. c) While the force is being applied measure the shortest distance between the foot supports. d) Record whether the foot supports have met the requirements.</p>		
9.2	Component mass		
	<p>If the wheelchair is intended to be dismantled for storage or transportation, any component that requires moving or handling that has a mass greater than 10 kg shall be provided with suitable handling devices (e.g. handles). The manufacturer shall provide information indicating the points where such components can be lifted and describing how they shall be handled during disassembly, lifting, carrying, and assembly to reduce risks to the person or persons moving or handling them.</p>		P
9.3	Pneumatic tyres		
	<p>All pneumatic tyres on the wheelchair shall have the same type of valve connection. Valves should be readily accessible when using the intended inflating tool. The tyres or the rims shall be marked with the maximum pressure in kPa, bar or PSI.</p>		P
9.4	Anterior pelvic support		
	<p>The wheelchair shall have provision for an anterior pelvic support to be fitted. The manufacturer of the wheelchair shall have available as an option an anterior pelvic support which can be used with that provision.</p>		P
9.5	Resistance to ignition		
9.5.1	Upholstered composite parts		
	<p>For upholstered parts which are composites of cover and filling, with or without a support base or interliner, the complete composite shall be tested by the methods specified in EN 1021-2:2006 or ISO 8191-2:1988. Progressive smouldering ignition and flaming ignition as defined in the Standard applied shall not occur.</p>		P

EN 15194:2017

1	Scope		-
	<p>This European Standard is intended to cover electrically power assisted cycles of a type which have a maximum continuous rated power of 0,25 kW, of which the output is progressively reduced and finally cut off as the vehicle reaches a speed of 25 km/h, or sooner, if the cyclist stops pedalling. This European Standard specifies safety requirements and test methods for the assessment of the design and assembly of electrically power assisted bicycles and sub-assemblies for systems using battery voltage up to 48 VDC or integrated a battery charger with a 230 V input. This European Standard specifies requirements and test methods for engine power management systems, electrical circuits including the charging system for the assessment of the design and assembly of electrically power assisted cycles and sub-assemblies for systems having a voltage up to and including 48 VDC or integrated a battery charger with a 230 V input.</p>		P
2	Normative references		-
	<p>The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.</p> <p>EN 14764:2005, City and trekking bicycles – Safety requirements and test methods</p> <p>EN 55014-1, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emission</p> <p>EN 55014-2, Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2: Immunity product family standard</p> <p>EN 60034-1, Rotating electrical machines – Part 1: Rating and performance</p> <p>EN 61000-3-2, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)</p> <p>EN 61000-3-3, Electromagnetic compatibility (EMC) – Part 3-3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for</p>	Be applied with	P

	<p>equipment with rated current ≤ 16 A</p> <p>ISO 2575, Road vehicles – Symbols for controls, indicators and tell tales</p> <p>ISO 11451-1, Road vehicles – Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 1: General principles and terminology</p> <p>ISO 11452-1, Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 1: General principles and terminology</p> <p>ISO 11452-2, Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 2: Absorber-lined shielded enclosure</p> <p>ISO 11452-3, Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 3: Transverse electromagnetic mode (TEM) cell</p> <p>ISO 11452-4, Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 4: Bulk current injection (BCI)</p> <p>ISO 11452-5, Road vehicles – Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 5: Stripline</p> <p>IEC 60068-2-75:1998, Environmental testing – Part 2: Tests – Test Eh: Hammer tests</p> <p>IEC 60364-5-52:2001, Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems</p> <p>IEC 60529:1991, Degrees of protection provided by enclosures (IP Code)</p> <p>CISPR 12, Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of off-board receivers</p> <p>CISPR 25:2008, Vehicles, boats and internal combustion engines - Radio disturbance characteristics - Limits and methods of measurement for the protection of on-board receivers</p>		
3	Terms and definitions		-
	For the purposes of this document, the following terms and definitions apply.		-

3.1	cycle vehicle that has at least two wheels and is propelled solely or mainly by the muscular energy of the person in that vehicle, in particular by means of pedals		P
3.2	bicycle two-wheeled cycle		P
3.3	fully assembled bicycle bicycle fitted with all the components necessary for its intended use		P
3.4	electrically power assisted cycle (EPAC) cycle, equipped with pedals and an auxiliary electric motor, which cannot be propelled exclusively by means of this auxiliary electric motor		P
3.5	no load current point current for which there is no torque on the driving wheel		P
3.6	full discharge of the battery point at which		P
3.7	cut off speed speed reached, by the EPAC, at the moment the current has dropped to zero or to the no load current value		P
3.8	maximum assisted speed by design maximum design speed up to which assistance is provided		P
3.9	electromagnetic compatibility ability of a vehicle or one of its electrical/electronic systems to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbance to anything in that environment		P
3.10	electromagnetic disturbance electromagnetic phenomenon which may degrade the performance of a vehicle or one of its electronic/electrical systems NOTE An electromagnetic disturbance may be electromagnetic noise, an unwanted signal or a change in the propagation medium itself.		P
3.11	electromagnetic immunity ability of a vehicle or one of its electronic/electrical systems to perform without degradation of its performance in the presence of specific electromagnetic disturbance		P
3.12	electromagnetic environment all electromagnetic phenomena present in a given situation		P
3.13	reference limit		P

	nominal level to which both the component type-approval of the vehicle and the conformity-of-production limit value refer		
3.14	reference antenna balanced half-wave dipole tuned to the measured frequency		P
3.15	wide-band emission emission which has a bandwidth exceeding that of a specific receiver or measuring instrument		P
3.16	narrow-band emission emission which has a bandwidth less than that of a specific receiver or measuring instrument		P
3.17	electronic/electrical subassembly (ESA) electronic and/or electrical component, or an assembly of components provided for installation into a vehicle, together with all electrical connections and associated wiring for the execution of several specific functions		P
3.18	ESA test test carried out on one or more specific ESAs		P
3.19	vehicle type with regard to electromagnetic compatibility vehicles that do not differ essentially in design and construction from the following aspect: - general layout of the electronic and/or electrical components; - overall size, layout and shape of the engine mounting and the disposition of the high-voltage wiring (where present); - raw material from which both the vehicle chassis and bodywork are constructed (e.g., a chassis or body made of glass fibre, aluminium or steel)		P
3.20	ESA type in relation to electromagnetic compatibility separate technical ESA unit that does not differ from other units in its essential design and construction aspects NOTE For example: -the function performed by the ESA; -the general layout of the electronic and/or electrical components; -direct vehicle control performed by the rider acting on the steering, the brakes and the accelerator control.		P
3.21	rated voltage voltage declared by the manufacturer of the bicycle		P
3.22	continuous rated power continuous (or constant) output power specified by manufacturer, at which the motor reaches its thermal		P

	equilibrium at given ambient conditions NOTE Thermal equilibrium: temperatures of motor parts do not vary more than 2K per hour.		
3.23	brake lever cut-off switch device that cuts off the motor assistance while using the brake lever		P
3.24	integrated charger charger which is a part of the bicycle and needs tools to be disassembled from it		P
4	Requirements		
4.1	General Electrically power-assisted bicycles shall comply with Clause 4, 5 and 6 of the European Standard EN 14764:2005 in addition to the specific requirements in Clause 4.2 of this standard.	To be complied with	P
4.2	EPAC specific additional requirements		-
4.2.1	Electric circuit The electrical control system shall be designed so that, should it malfunction in a hazardous manner, it shall switch off power to the electric motor. If symbols are used, their meaning shall be described in the instructions for use. Their function is one described in ISO 2575, their design shall be in accordance to that standard.		P
4.2.2	Batteries		-
4.2.2.1	Requirements EPAC and pack of batteries shall be designed in order to avoid risk of fire, mechanical deterioration resulting from abnormal use. Compliance is checked by the test described in 4.2.2.2. During the test the EPAC and the batteries shall not emit flames, molten metal or poisonous ignitable gas in hazardous amounts and any enclosure shall show no damage that could impair compliance with this European Standard. Safety and compatibility of the combination battery/charger combination shall be ensured, according to the manufacturer's specifications. The battery terminals shall be protected against creating an accidental short circuit. Care shall be taken to ensure that the batteries are protected against overcharging. An appropriate overheating and short circuit protection device shall be fitted. NOTE Indication and example of solutions are given in Annex A. Batteries and the charger unit shall be labelled in order to be able to check their compatibility.		P

4.2.2.2	<p>Test method</p> <p>1) Battery terminals are short-circuited with the batteries in a fully charged condition.</p> <p>2) Motor terminals are short-circuited; all commands are in ON position, whilst the batteries are fully charged.</p> <p>3) The EPAC is operated with the electric motor or drive system locked up so as to fully discharge the battery or until the system stops.</p> <p>4) The battery is charged for double the recommended charging period or for 24 hours depending upon which is the longest period.</p>		P
4.2.3	Electric cables and connections		-
	<p>Requirements</p> <p>Cable and plug temperature shall be lower than that specified by the manufacturer of the cables and plugs.</p> <p>There shall be no corrosion on plug pins and no damage to cable and plug insulation.</p>		P
4.2.3.2	<p>Test method</p> <p>Discharge the fully charged EPAC battery to the discharging limit specified by the EPAC or ESA manufacturer at the maximum current allowable by the system and record it, giving consideration to the electric motor and/or the controller and/or the battery controller. Measure the cable and plug temperatures and ensure, by examination, that there is no deterioration of the insulation on either assembly.</p>		P
4.2.3.3	<p>Wiring</p> <p>a) Wire ways shall be smooth and free from sharp edges.</p> <p>b) Wires shall be protected so that they do not come into contact with burrs, cooling fins or similar sharp edges that may cause damage to their insulation. Holes in metal through which insulated wires pass shall have smooth well-rounded surfaces or be provided with bushings.</p> <p>c) Wiring shall be effectively prevented from coming into contact with moving parts. Separate parts of the EPAC that can move in normal use or during user maintenance relative to each other, shall not cause undue stress to electrical connections and internal conductors, including those providing earthing continuity. Compliance with a), b), c) shall be checked by inspection.</p> <p>d) If an open coil spring is used, it shall be correctly installed and insulated. Flexible metallic tubes shall not cause damage to the insulation of the conductors contained within them. Compliance with d) shall be</p>		P

	<p>checked by inspection and by the following test method.If flexing occurs in normal use, the appliance is placed in its normal operational position and is supplied at rated voltage under normal operation.</p> <p>e) The movable part is moved backwards and forwards, so that the conductor is flexed through the largest angle permitted by its construction.For conductors that are flexed in normal use, flex movable part for 10 000 cycles at a test frequency of 0,5 Hz.For conductors that are flexed during user maintenance, flex the movable part for 100 cycles at the same frequency at $(20 \pm 5) ^\circ\text{C}$.The wiring and its connections shall withstand the electrical strength test. The test voltage expressed in V shall be equal to $(500 + 2 \times V_r)$ for 2 min and applied between live parts and other metal parts only.</p> <p>NOTE V_r is the rated voltage.</p> <p>f) The insulation of internal wiring shall withstand the electrical stress likely to occur in normal use.</p> <p>g) In case of integrated battery charger, electric safety of battery charger applies.</p>		
4.2.3.4	<p>Power cables and conduits</p> <p>Conduit entries, cable entries and knock-outs shall be constructed or located so that the introduction of the conduit or cable does not reduce the protection measures adopted by the manufacturer.Compliance is checked by inspection.</p> <p>NOTE Power cables selection should be made referring to IEC 60364-5-52:2001, Clauses 522.1.2, 523.1523.3 and Table A 52-10.</p>		P
4.2.3.5	<p>External and internal electrical connections</p> <p>Electrical connection shall comply with IEC 60364-5-52:2001, Clauses 526.1 and 526.2.</p>		P
4.2.3.6	<p>Moisture resistance</p> <p>The EPAC are subjected to the test of IEC 60529 as follows: IPX4 appliances as described in Clause 14.2.4.a.</p>		P
4.2.3.7	<p>Mechanical strength</p> <p>EPAC shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use. Compliance is checked by:</p> <p>-applying impacts to the battery pack mounted on the EPAC by means of the spring hammer as specified in IEC 60068-2-75. The battery pack is rigidly supported and three impacts are applied to every point of the</p>		P

	<p>enclosure that is likely to be weak with an impact energy of $(0,7 \pm 0,05)$ J. After the test the battery pack shall show no damage that could impair compliance with this European Standard;</p> <p>-detachable battery packs are submitted to free fall at a height of 0,90 meter in three different positions. After the test the battery pack shall show no damage that could lead to emission of dangerous substances (gas or liquid) ignition, fire or overheating.</p> <p>NOTE It is recalled to the attention that batteries had to fulfil all relevant tests to ensure safety.</p>		
4.2.4	Power management		-
4.2.4.1	<p>Requirements</p> <p>When tested by the method described in 4.2.4.2 the recordings shall show that:</p> <p>a) assistance shall be provided only when the cyclist pedals forward. This requirement has to be checked according to the test methods described in 4.2.4.2.2 a);</p> <p>b) assistance shall be cut off when the cyclist stops pedalling forward such that the cut off distance does not exceed 5 m with the use of brake lever cut off switch or 2 m without the use of brake lever cut off switch. This requirement has to be checked according to the test methods described in 4.2.4.2.2 b);</p> <p>c) the output or assistance shall be progressively reduced (see Annex B) and finally cut off as the vehicle reaches the maximum assistance speed as designed. This requirement has to be checked according to the test methods described in 4.2.4.2;</p> <p>d) the assistance shall be progressively and smoothly managed.</p>	See 4.2.4.2	P
4.2.4.2	Test method – Electric motor management		-
4.2.4.2.1	<p>Test conditions</p> <p>a) The test may be performed either on a test track, a test bench or on a stand which keeps the motor driven wheel free of the ground.</p> <p>b) The test track shall be according to EN 14764:2005, Clause 4.6.8.5.1.1.</p> <p>c) The time-measuring device shall have an accuracy of $\pm 2\%$.</p> <p>d) The ambient temperature shall be between 5°C and 35°C.</p> <p>e) Maximum wind speed shall not exceed 3 m/s.</p> <p>f) The battery shall be fully charged according to the</p>		P

	manufacturer's instructions.		
4.2.4.2.2	<p>Test procedure</p> <p>a) Check that there is no electric motor assistance when pedalling backwards. The test to ensure the compliance to this clause shall be adapted to the technology used. For example, pedal backwards and check the no load current point or that no torque is delivered on the driving wheel.</p> <p>b) Worst case conditions of gear ratio and speed shall be applied.</p> <p>c) Worst condition for speed is defined as 90% of cut off speed.</p> <p>d) Measure the distance travelled from cessation of pedalling and actuating the switch brake simultaneously (if any) to no power corresponding to no load current point provided by the electric motor by using:</p> <ul style="list-style-type: none"> - speed versus time measurement, -direct or indirect torque versus distance measurement (e.g. motor current), -or any other appropriate method. <p>e) Carry out the test ten times and then average.</p>		P
4.2.4.3	Start up assistance mode		-
4.2.4.3.1	<p>Requirements</p> <p>EPAC can be equipped with a start up assistance mode up to 6 km/h designed speed or lower values as specified by the manufacturer. Unauthorized use shall be prevented. This mode shall be activated by the voluntary and maintained action of the user either when riding without pedalling or when the user is pushing the cycle.</p>		P
4.2.4.3.2	Test method		-
4.2.4.3.2.1	<p>Test conditions</p> <p>a) The test may be performed either on a test track, a test bench or on a stand that keeps the motor driven wheel free of the ground.</p> <p>b) The speed-measuring device shall have the following characteristics:</p> <ul style="list-style-type: none"> Accuracy: $\pm 2\%$ Resolution: 0,1 km/h <p>c) The ambient temperature shall be between 5 °C and 35 °C.</p> <p>d) Maximum wind speed: 3 m/s.</p> <p>e) The battery shall be fully charged according to the manufacture's instructions.</p>		P
4.2.4.3.2	Test procedure		-

.2			
	<p>a) Pre-condition the EPAC by running it for 5 min at 80% of the maximum assistance speed as declared by the manufacturer, then stop.</p> <p>b) Activate the start up assistance mode and verify that the speed increases up to 6 km/h maximum designed speed or lower value.</p> <p>c) Verify that speed is going down to 0 km/h when start up assistance mode is deactivated and the current drops to a value equal to or less than no load current point when free rolling.</p> <p>d) Activate the start up assistance mode.</p> <p>e) Verify that speed decreases when the start up assistance mode is activated and the current drops to a value equal to or less than no load current point.</p> <p>f) Activate the start up assistance mode and maintain it for 1 min.</p> <p>g) Verify that speed is equal to or less than 6 km/h.</p>		P
4.2.5	Electro Magnetic Compatibility		-
4.2.5.1	<p>Emission</p> <p>The EPAC and ESA shall conform to Annex C.</p>	See Annex C	P
4.2.5.2	<p>Immunity</p> <p>The EPAC and ESA shall conform to Annex C.</p>		P
4.2.5.3	<p>Battery charger</p> <p>As an EPAC is not intended to be used while charging, for integrated charger the whole EPAC plus integrated charger shall be tested. The following European standards apply for battery charger: EN 55014-1, EN55014-2, EN61000-3-2, EN61000-3-3.</p>		P
4.2.6	Maximum speed for which the electric motor gives assistance		P
4.2.6.1	<p>Requirements</p> <p>The maximum speed for which the electric motor gives assistance may differ by $\pm 5\%$ of the speed indicated on the label described within Clause 5 when determined according to the test method described in 4.2.6.2, from 25 km/h or lower values as specified by the manufacturer. During a production conformity check, the maximum speed may differ by $\pm 10\%$ from the above-mentioned determined value.</p>		P
4.2.6.2	Test method		-
4.2.6.2.1	<p>Test conditions</p> <p>a) The test may be performed either on a test track, a test bench or on a stand that keeps the motor driven wheel</p>	25 °C	P

	<p>free of the ground.</p> <p>b) The speed-measuring device shall have the following characteristics:</p> <ul style="list-style-type: none"> -Accuracy: $\pm 2\%$ - Resolution: 0,1 km/h <p>c) The ambient temperature shall be between 5 °C and 35 °C.</p> <p>d) Maximum wind speed: 3 m/s.</p> <p>e) The battery shall be fully charged according to the manufacturer instructions.</p>		
4.2.6.2.2	<p>Test procedure</p> <p>Any appropriate method for checking for this requirement is acceptable; one solution is to measure the cut-off speed, another being to measure the torque output. The following example describes the cut-off speed test.</p> <p>a) Pre-condition the EPAC by running it for 5 min at 80% of the maximum assistance speed as declared by the manufacturer.</p> <p>b) Record continuously the current and note the speed at which the current drops to a value equal to or less than "no load current point".</p> <p>c) Whilst pedalling, ride steadily to reach a speed equal to 1,25 times (if possible by design) the maximum assistance speed as declared by the manufacturer.</p> <p>d) Verify the noted value in b) is equal to or less than the maximum speed declared by the manufacturer.</p>		P
4.2.7	Maximum power measurement		-
	<p>Measurement at the engine shaft</p> <p>The maximum continuous rated power shall be measured according to EN 60034-1 when the motor reaches its thermal equilibrium as specified by the manufacturer.</p> <p>NOTE Thermal equilibrium: temperatures of motor parts do not vary more than 2K per hour. In circumstance where the power is measured directly at the shaft of the electronic motor, the result of the measurement shall be decreased by 1,10 to consider the measurement uncertainty and then by 1,05 to include for example the transmission losses, unless the real values of these losses are determined.</p>		P
4.2.7.2	<p>Alternative method</p> <p>When the power is measured at the wheel, the result of the measurement is the reading value.</p> <p>Annex D gives guidance on how to measure the power at the wheel.</p>	See Annex D	P

5	<p>Marking, labelling</p> <p>In addition to the requirements of EN 14764, the EPAC shall be visibly and durably marked according to EN 15194 as follows:</p> <ul style="list-style-type: none"> - EPAC <p>According to EN 15194</p> <ul style="list-style-type: none"> - XX km/h1) - XX W2) 		P
6	<p>Instruction for use</p> <p>In addition to the instructions required by the bicycles standard EN 14764, each EPAC shall be provided with a set of instructions containing information on:</p> <ol style="list-style-type: none"> 1) concept and description of electric assistance; 2) recommendation for washing; 3) control and tell tales; 4) specific EPAC recommendations for use; 5) specific EPAC warnings; 6) recommendations about battery charging and charger use as well as the importance of following the instruction contained on the label of the battery charger. 		P

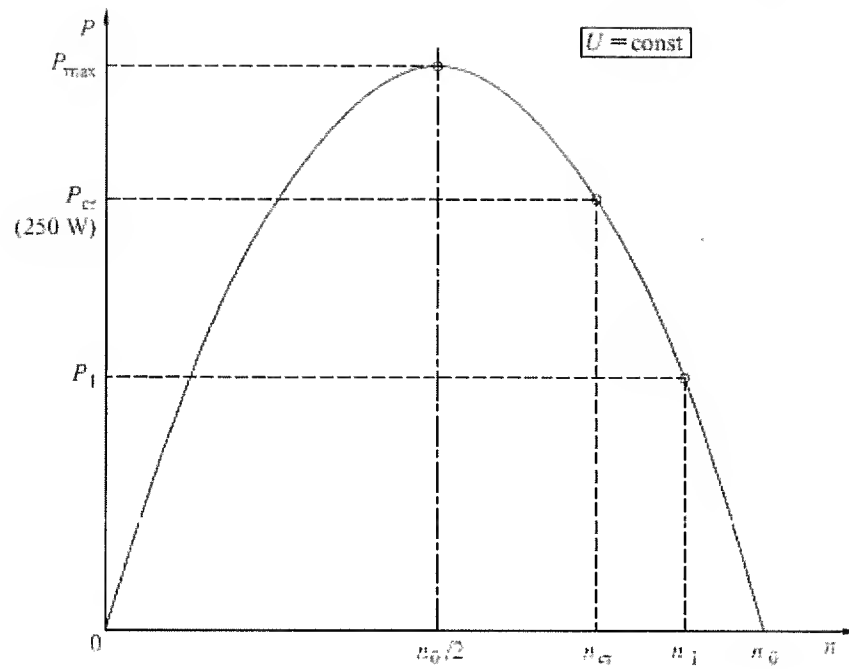


Figure B.2 — Speed-torque diagram function

Because the natural speed-torque-diagram is a linear falling function (at constant voltage U) the output-power-torque and the output-power-speed function is a parabolic one (see Figure B.2). Therefore, if the torque falls

EN 61000-6-3**3.1 Continuous Disturbance Voltage at Mains Terminal.****3.1.1 Test Equipment List and Details**

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
No.2 Radio factory of Changzhou	Screened Room	P-22	No	12/6/16	12/5/18
AFJ	EMI Receiver	ER55 CR/2.8	55790015165	6/23/16	6/22/18
AFJ	16A LINE Impedance Stabilization	LS16C	16010020077	6/23/16	6/22/18

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

3.1.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

3.1.3 Limits of Continuous Disturbance Voltage at Mains Terminal.

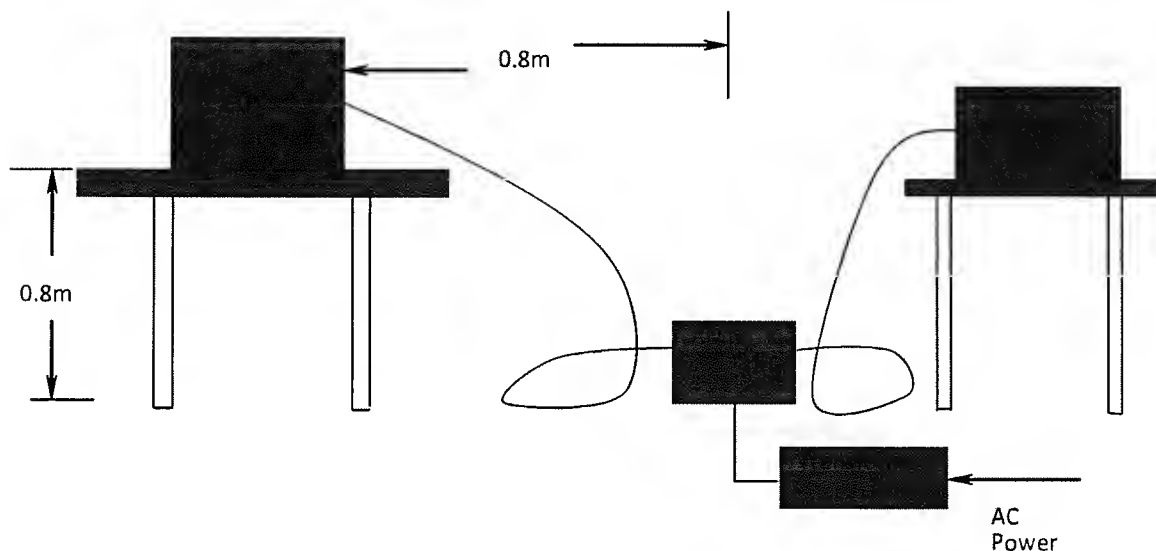
Equipment type	Frequency range MHz	Limit values dB μ V	
		Quasi-peak	Average
Household appliance	0.15 to 0.5	66-56 ^a	56- 46 ^a
	0.5 to 5	56	46
	5 to 30	60	50

^a Decreasing linearly with logarithm of the frequency.

Note: If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

3.1.4 Configuration

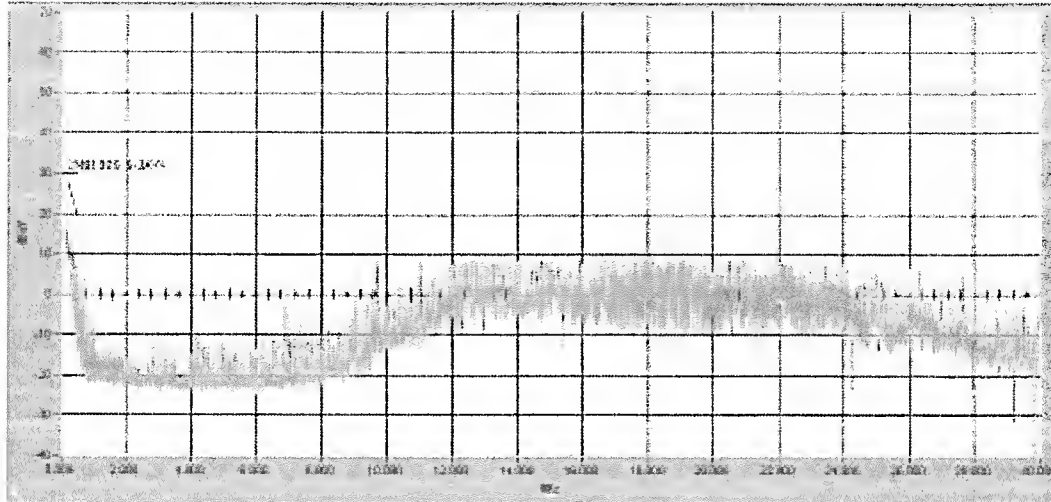
The configuration is in accordance with the requirement in EN61000-6-3, the sketch map as follow:



3.1.5 Test Data and Records

Disturbance Voltage at the Mains Terminal TEST DATA			EN61000-6-3
Frequency	Amplitude	Detector	Limit
MHz	dB μ V	QP/Ave/Peak	dB μ V
0.15-0.5	*	QP	66-56
			Decreasing linearly with logarithm of the frequency
0.50-5	*	QP	56
5-30	*	QP	60

* Means the continuous disturbance voltage level 10dB lower than limits.



3.1.6 Verdict

The EUT met the requirement.

3.2 Radiated disturbances

3.2.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
SCHAFFNER	Receive Antenna	CBL6112B	/	12/6/15	12/5/17
AFJ	EMI Receiver	ER55 CR/2.8	55790015165	6/23/15	6/22/17
Albatross Project	3Meter Anechoic Chamber		9290832	12/13/15	12/12/17
AFJ	16A LINE Impedance Stabilization Network	LS16C	16010020077	6/23/15	6/22/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

3.2.2 Description of Measurement Conditions

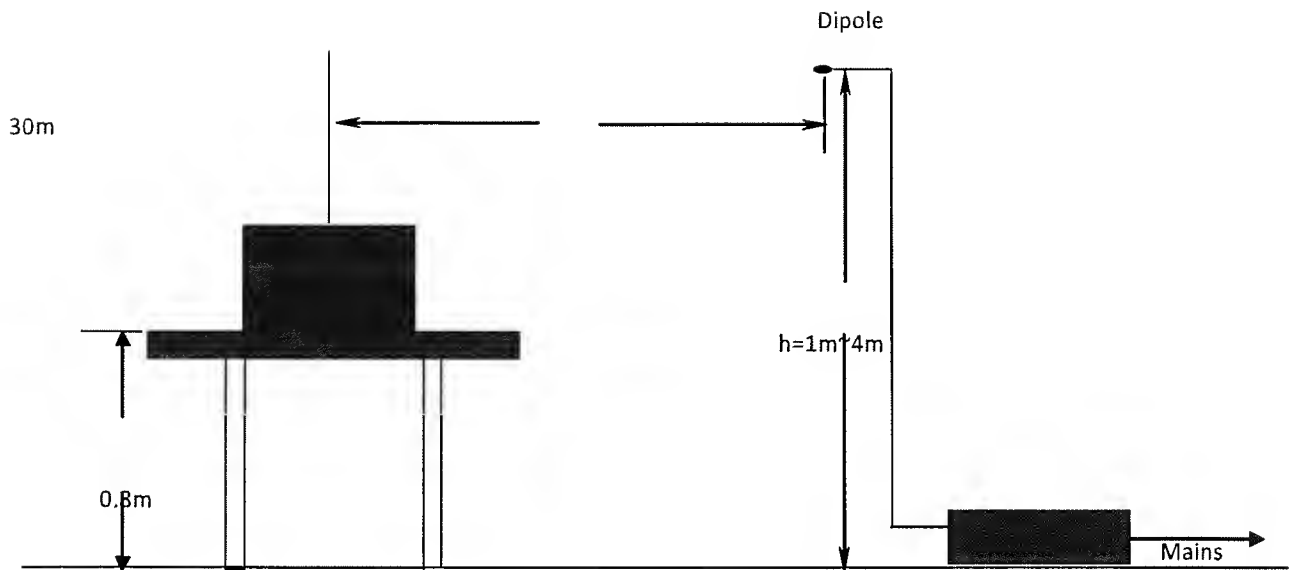
Temperature: 20°C
Humidity: 60%
Pressure: 1033mbar
Electromagnetic environment: normal

3.2.3 Limits of radiated disturbances of class B ITE at a measuring distance of 10m.

Frequency range MHz	Quasi-peak limits(10m) dB(μV/m)
30 to 230	30
230 to 1000	37
NOTE: The lower limit shall apply at the transition frequency. NOTE: Additional provisions may be required for cases where interference occurs.	

3.2.4 Configuration

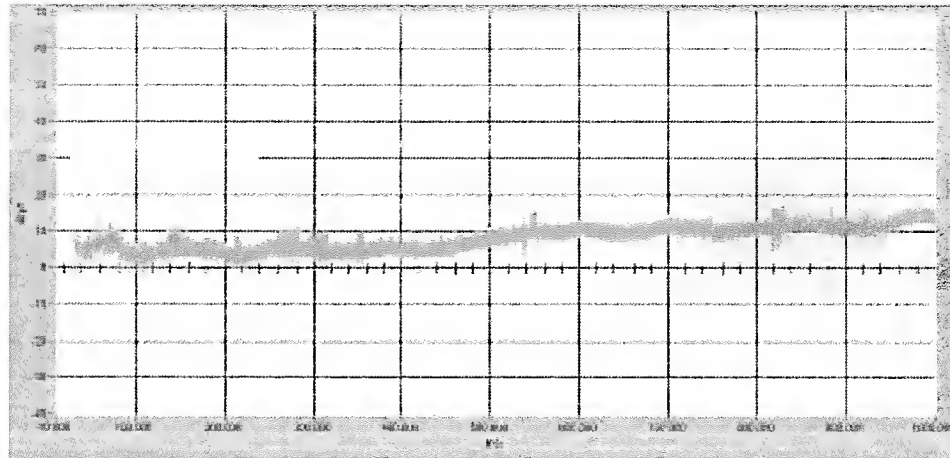
The configuration is in accordance with the requirement in EN61000-6-3, the sketch map as follow:



3.2.5 Test Data and Records

Radiated disturbances TEST DATA			EN61000-6-3	
Frequency	Amplitude	Detector	Limit(10m)	Margin
MHz	dB($\mu\text{V/m}$)	Qp/Ave/Peak	dB($\mu\text{V/m}$)	dB
30 to 230	*	QP	30	
230 to 1000	*	QP	37	

NOTE: * Means the radiated disturbance level 10dB lower than limits



3.2.6 Verdict

The EUT met the requirement.

3.3 Discontinuous Disturbance Voltage at Mains Terminal (Click)

3.3.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
No.2 Radio factory of Changzhou	Screened Room	P-22	No	12/6/15	12/5/17
AFJ	CLICK Analyzer	CL-55C	55040019044	3/7/15	3/7/17
AFJ	16A LINE Impedance Stabilization Network	L516C	16010020077	6/23/15	6/22/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

3.3.2 Description of Measurement Conditions

Temperature: 22℃

Humidity: 56%

Pressure: 1033mbar

Electromagnetic environment: normal

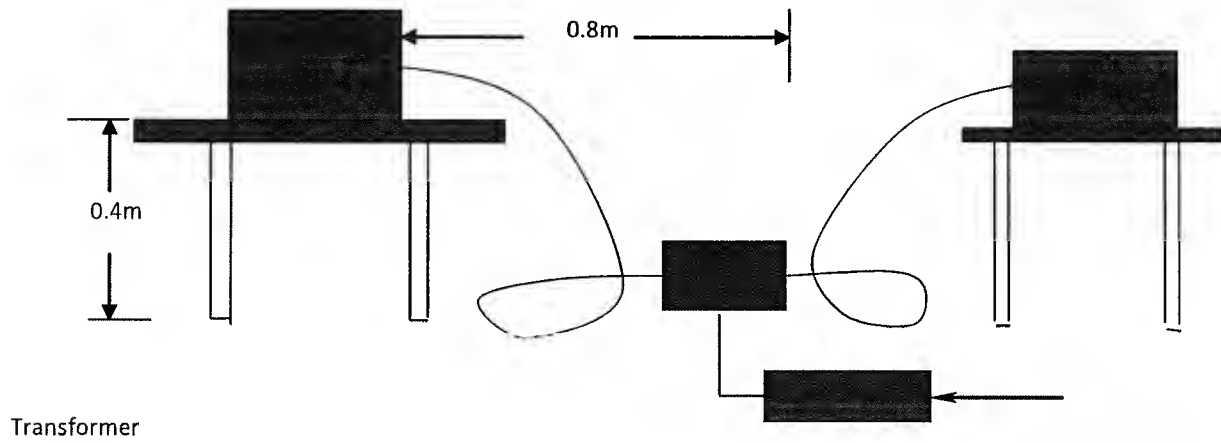
3.3.3 Limits of Click

For discontinuous disturbance, the click limit is attained by increasing the relevant limit of Continuous Disturbance Voltage with:

$$44\text{dB} \quad \text{for} \quad N < 0.2 \quad \text{or} \\ 20\lg(30/N) \text{ dB} \quad \text{for} \quad 0.2 \leq N < 30$$

3.3.4 Configuration

The configuration in accordance with the requirement in EN61000-6-3, the sketch map as follow:



3.3.5 Verdict

The EUT met the requirement.

EN 61000-6-1

Description of Performance Criterion (According with EN61000-6-1 Section 4)

Performance Criterion A

The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacture, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion B

The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however, no change of actual operating state or stored data is allowed. If the minimum performance level or the permissible performance loss is not specified by the manufacture, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance Criterion C

Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

4.1 SURGES

4.1.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Japan	Surge Lite	LSS-6030	9099E00350	10/14/15	10/13/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

4.1.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

4.1.3 Configuration

The configuration is in accordance with the requirement in EN61000-4-5.

4.1.4 Test Data and Records

Level	Voltage	Poll	Path	Pass	Fail
1	1kV	±	L-N	B	
2	2kV	±	L-PE, N-PE	B	
3					
4					

4.1.5 Verdict

The EUT was working as normal, so they met the requirement of performance criteria B.

4.2 ESD

4.2.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Shanghai Sanki	Electrostatic Discharge tester	ESD-320	0329501C	6/23/15	6/22/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

4.2.2 Description of Measurement Conditions

Temperature: 21 °C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

4.2.3 Configuration

The configuration is in accordance with the requirement in EN61000-4-2.

4.2.4 Test Data and Records

Air Discharge

Test Levels																
EN61000-4-2 Test Points	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV	-10 kV	+10 kV	-12.5 kV	+12.5 kV	-15 kV	+15 kV	-20 kV	+20 kV
EUT Front Side	B	B	B	B	B	B	B	B								
EUT Top Side	B	B	B	B	B	B	B	B								
EUT Back Side	B	B	B	B	B	B	B	B								
EUT Left Side	B	B	B	B	B	B	B	B								
EUT Right Side	B	B	B	B	B	B	B	B								

Direct Contact

Test Levels																
EN61000-4-2 Test Points	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV	-10 kV	+10 kV	-12.5 kV	+12.5 kV	-15 kV	+15 kV	-20 kV	+20 kV
EUT Front Side	B	B	B	B												
EUT Top Side	B	B	B	B												
EUT Back Side	B	B	B	B												
EUT Left Side	B	B	B	B												
EUT Right Side	B	B	B	B												

4.2.5 Verdict

The EUT was working as normal, so they met the requirement of performance criteria B.

4.3 EFT/B

4.3.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Shanghai Sanki	E.F.TB Generator	8014	069504E	6/23/15	6/22/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

4.3.2 Description of Measurement Conditions

Temperature: 21 °C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

4.3.3 Configuration

The configuration is in accordance with the requirement in EN61000-4-4.

4.3.4 Test Data and Records

Test Levels (kV)									
EN61000-4-4 Test Points		+0.25	-0.25	+0.5	-0.5	+1.0	-1.0	+2.0	-2.0
Power Port	L1	B	B	B	B				
	L2	B	B	B	B				
	L1+L2	B	B	B	B				
I/O Port		B	B	B	B				

4.3.5 Verdict

The EUT was working as normal, so they met the requirement of performance criteria B.

4.4 INJECTED CURRENTS

4.4.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
FLUKE	Synthesized RF Signal Generator	6061A	5080312	3/23/15	3/22/17
QF	Broadband Power Amplifier	QF3860	No	4/15/15	4/14/17
QF	Millivoltmeter	QF2281	92028	4/15/15	4/14/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

4.4.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

4.4.3 Configuration

The configuration in accordance with the requirement in EN61000-4-6.

4.4.4 Test Data and Records

EN61000-4-6 Test Points	Frequency range MHz	Levels	Voltage Level (e.m.f.)V	Pass	Fail
Power Line	0.15-230MHz	1	1		
		2	3	A	
		3	10		
		X	Special		
I/O Line	0.15-230MHz	1	1		
		2	3	A	
		3	10		
		X	Special		

4.4.5 Verdict

The EUT was working as normal, so they met the requirement of performance criteria A.

4.5 VOLTAGE DIPS AND INTERRUPTIONS

4.5.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
Japan	Voltage Dip Simulator	VDS-220B	2199D00098	10/22/15	10/21/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

4.5.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 58%

Pressure: 1033mbar

Electromagnetic environment: normal

4.5.3 Configuration

The configuration in accordance with the requirement in EN61000-4-11.

4.5.4 Test Data and Records

Environmental phenomena		Test level in % U_T	Duration (in periods of the rated frequency)	Phase Angle	Pass	Fail
Interruptions		0	0.5T	0/180	B	
Voltage dips in % U_T	60	40	10T	0/180	B	
	30	70	50T	0/180	B	

4.5.5 Verdict

The EUT was working as normal, so they met the requirement of performance criteria B.

EN 61000-3-2

1.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
EMC-PARTNER	Harmonics and Flicker Analyzer	HARMONIC S-1000	HAR1000-40	10/09/15	10/08/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

1.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 60%

Pressure: 1033mbar

Electromagnetic environment: normal

1.3 Configuration

The configuration is in accordance with the requirement in EN61000-3-2.

1.4 Test Data and Records

Order	Freq[Hz]	Iavg[A]	Iavg%L[%]	Imax[A]	Imax%L[%]	Limit[A]	Status
1	50	0.3129		0.4966			
2	100	0.0133	0.1241	0.0171	1.4563	1.0800	
3	150	0.0245	2.2358	0.0826	3.6303	2.3000	
4	200	0.0000	0.0051	0.0059	1.3626	0.4300	
5	250	0.0021	0.2193	0.0233	2.0399	1.1400	
6	300	0.0000	0.0000	0.0031	1.0376	0.3000	
7	350	0.0004	0.0549	0.0154	1.9975	0.7700	
8	400	0.0000	0.0000	0.0013	0.5838	0.2300	
9	450	0.0002	0.0499	0.0102	2.5482	0.4000	
10	500	0.0000	0.0000	0.0004	0.1990	0.1840	
11	550	0.0000	0.0091	0.0054	1.6276	0.3300	
12	600	0.0000	0.0000	0.0003	0.1990	0.1533	
13	650	0.0000	0.0000	0.0026	1.2498	0.2100	
14	700	0.0000	0.0000	0.0002	0.1858	0.1314	
15	750	0.0000	0.0000	0.0030	1.9938	0.1500	
16	800	0.0000	0.0000	0.0002	0.1592	0.1150	
17	850	0.0000	0.0000	0.0022	1.6602	0.1324	
18	900	0.0000	0.0000	0.0003	0.2985	0.1022	
19	950	0.0000	0.0000	0.0017	1.4431	0.1184	
20	1000	0.0000	0.0000	0.0002	0.2654	0.0920	
21	1050	0.0000	0.0000	0.0014	1.3102	0.1071	
22	1100	0.0000	0.0000	0.0001	0.1460	0.0836	
23	1150	0.0000	0.0000	0.0012	1.2478	0.0978	
24	1200	0.0000	0.0000	0.0001	0.0796	0.0767	
25	1250	0.0000	0.0000	0.0011	1.2207	0.0900	
26	1300	0.0000	0.0000	0.0001	0.0862	0.0708	
27	1350	0.0000	0.0000	0.0008	0.9521	0.0833	
28	1400	0.0000	0.0000	0.0001	0.1858	0.0657	
29	1450	0.0000	0.0000	0.0007	0.8653	0.0776	
30	1500	0.0000	0.0000	0.0001	0.0995	0.0613	
31	1550	0.0000	0.0000	0.0007	1.0091	0.0726	
32	1600	0.0000	0.0000	0.0001	0.2123	0.0575	
33	1650	0.0000	0.0000	0.0005	0.8057	0.0682	
34	1700	0.0000	0.0000	0.0001	0.2256	0.0541	
35	1750	0.0000	0.0000	0.0004	0.6646	0.0643	
36	1800	0.0000	0.0000	0.0001	0.1194	0.0511	
37	1850	0.0000	0.0000	0.0005	0.9033	0.0608	
38	1900	0.0000	0.0000	0.0001	0.1261	0.0484	
39	1950	0.0000	0.0000	0.0004	0.7406	0.0577	
40	2000	0.0000	0.0000	0.0001	0.1327	0.0460	
Result: Pass							

1.5 Verdict

The EUT met the requirement.

EN 61000-3-3

2.1 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Last Cal. Date	Cal. Due Date
EMC-PARTNER	Harmonics and Flicker Analyzer	HARMONIC S-1000	HAR1000-40	10/09/15	10/08/17

Statement of Traceability: XMTEST certifies that all calibrations have been performed using suitable standards traceable to the CHINA SCIENTIFIC MEASUREMENT INSTITUTE.

2.2 Description of Measurement Conditions

Temperature: 21°C

Humidity: 60%

Pressure: 1033mbar

Electromagnetic environment: normal

2.3 Configuration

The configuration is in accordance with the requirement in EN61000-3-3.

2.4 Test Data and Records

Plt = 0.140				
	Pst	dmax	dc	dt>Lim
1	0.084	0.350	0.310	0.000
2	0.075	0.000	0.100	0.000
3	0.079	0.000	0.100	0.000
4	0.223	1.090	1.110	0.000
5	0.092	0.400	0.320	0.000
6	0.074	0.000	0.110	0.000
7	0.077	0.000	0.080	0.000
8	0.156	1.090	1.140	0.000
9	0.083	0.340	0.310	0.000
10	0.072	0.000	0.110	0.000
11	0.072	0.000	0.090	0.000
12	0.237	1.090	1.080	0.000
Result: Pass				

2.5 Verdict

The EUT met the requirement.

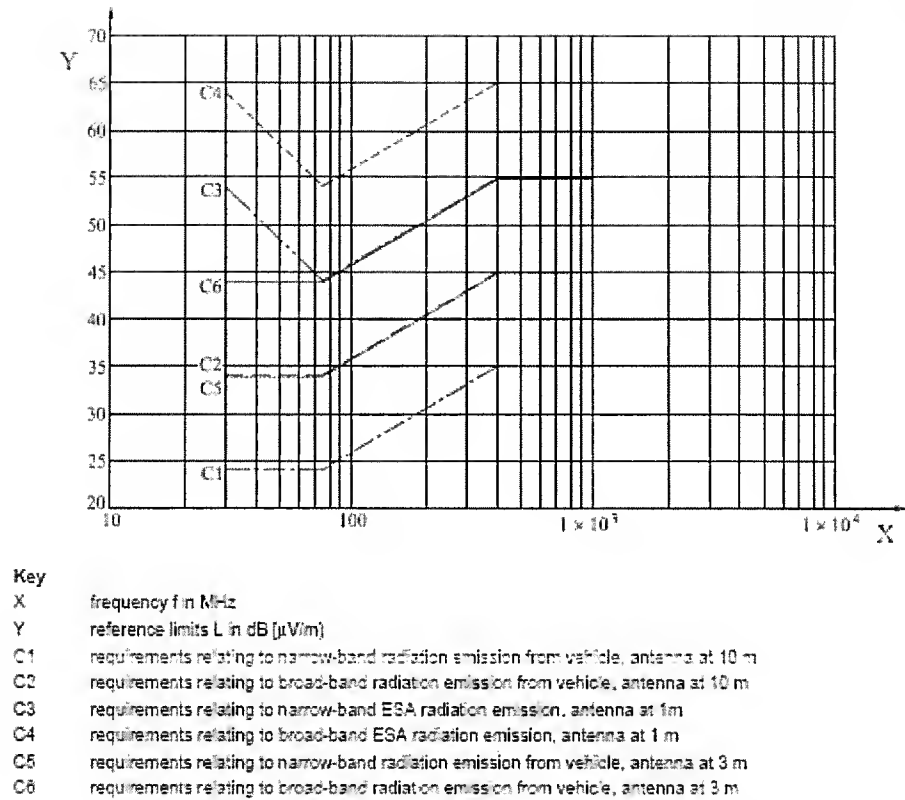


Figure C.1 — Overview of electromagnetic radiation emissions reference limits

Table C.1 — Overview of electromagnetic radiation emissions reference limits – Curves characteristics

Characteristic	Value	Band-width	Antenna distance [m]	Equation for L [dB($\mu\text{V/m}$)] within f [MHz]		
				30...75	75...400	400...1000
C 1	mean value	narrow-band	10 ± 0.2	$24 = \text{const.}$	$24 + 15, 13 \cdot \log(f/75)$	$35 = \text{const.}$
C 2	quasi-peak	broad-band	10 ± 0.2	$34 = \text{const.}$	$34 + 15, 13 \cdot \log(f/75)$	$45 = \text{const.}$
C 3	mean value	narrow-band	1.0 ± 0.05	$64 - 25, 13 \cdot \log(f/30)$	$44 + 15, 13 \cdot \log(f/75)$	$55 = \text{const.}$
C 4	quasi-peak	broad-band	1.0 ± 0.05	$64 - 25, 13 \cdot \log(f/30)$	$54 + 15, 13 \cdot \log(f/75)$	$65 = \text{const.}$
C 5	mean value	narrow-band	3 ± 0.05	$34 = \text{const.}$	$34 + 15, 13 \cdot \log(f/75)$	$45 = \text{const.}$
C 6	quasi-peak	broad-band	3 ± 0.05	$44 = \text{const.}$	$44 + 15, 13 \cdot \log(f/75)$	$55 = \text{const.}$

4.4 Earthing continuity test report

Manufacturer : ZHEJIANG OKAI VEHICLE CO.,LTD

No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

- EUT : Electric Scooter
- Test model : ES09
- Ratings : 36V;250W
- Test Equipment : Ground Resistance Tester

Withstanding Voltage/Arc/Insulation/Grounding Tester

Model : WB2678A

- Test conditions : 50Hz
- Date : Feb.05, 2018

Test Point	Diameter of Conductor (mm ²)	Test Result-Voltage Drop (V)
Control transformer	1.25	0.36
Control panel	1.25	0.15
L1-PE	1.25	0.15
L2-PE	1.25	0.15
L3-PE	1.25	0.15
Motor1	1.25	0.26
Motor2	1.25	0.26
Motor3	1.25	0.26
Motor4	1.25	0.26
Motor5	1.25	0.26
Motor6	1.25	0.26
Motor7	1.25	0.26
Motor8	1.25	0.26
Controller	1.25	0.33

Insulation resistance test report

Manufacturer : ZHEJIANG OKAI VEHICLE CO.,LTD

No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

- EUT : Electric Scooter
- Test model : ES09
- Ratings : 36V;250W
- Test Equipment : Ground Resistance Tester
Withstanding Voltage/Arc/Insulation/Grounding Tester
Model : WB2678A
- Test conditions : 50Hz
- Date : Feb.05, 2018

Test Point	Test Result (MΩ)
Control transformer	623
Control panel	856
L1-PE	>1000
L2-PE	>1000
L3-PE	>1000
Motor1	814
Motor2	913
Motor3	990
Motor4	967
Motor5	923
Motor6	925
Motor7	948
Motor8	944
Controller	884

Withstand voltage test report

Manufacturer : ZHEJIANG OKAI VEHICLE CO.,LTD

No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

- EUT : Electric Scooter
- Test model : ES09
- Ratings : 36V;250W
- Test Equipment : Ground Resistance Tester
Withstanding Voltage/Arc/Insulation/Grounding Tester
Model : WB2678A
- Test conditions : 50Hz
- Date : Feb.05, 2018

Test Point	Test Result (MΩ)
Control transformer	Pass
Control panel	Pass
L1-PE	Pass
L2-PE	Pass
L3-PE	Pass
Motor 1	Pass
Motor2	Pass
Motor3	Pass
Motor4	Pass
Motor5	Pass
Motor6	Pass
Motor7	Pass
Motor8	Pass
Controller	Pass

Noise Test Report

No. XMT0201704830L/MD

Date:Feb.05, 2018

Manufacturer: ZHEJIANG OKAI VEHICLE CO.,LTD

No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

Report on the submitted sample said to be

Ref No. : XMT0201704830L/MD

Testing Period : Feb.05, 2018

Test Method :With reference to BS EN11202; EN ISO 3746 and ISO/TR 11688-1

Test Results : Please refer to next pages

Noise test at workstation

I. Applicable standards

1. EN ISO 3746: Acoustics-Determination of sound power levels of noise sources using sound pressure—Survey method using an enveloping measurement surface over a reflecting plane.
2. EN ISO 11202: Acoustics—Noise emitted by machinery and equipment—Measurement of emission sound pressure levels at the work station and at other specified positions—Survey method in situ.
3. ISO/TR 11688-1: Acoustics—Recommended practice for the design of low-noise machinery and equipment—Part 1 : Planning.

II. Test instrument

The sound level meter used in the noise measurement is TES1350A manufactured by TES Electrical Electronic Corp. with the following features:

- Portable with light weight & easy operation.
- Measurement range from 35 to 130 dB (A) .
- Type 1 precision.
- With “F” & “S” detect mode in accordance with IEC 651 type 1.
- Built in A-weighting network.
- Equipped with a high prepolarized condenser microphone.
- With automatic & manual display.
- DC output for level recorder.

III. Measurement method

The measurements of this test have been carried out by a hand-held sound level meter, and readings are taken by A-frequency weighting at each measuring position.

For operator positions in process of measurement, the measuring instrument is to be set at a distance of 1 m from the machine and 1.5 m above the floor.

IV. Test environment

The test was carried out in the location of machine inside the factory, and the background noise has been ensure that its measuring value is lower than that of machine.

V. Test result

1. Description of testing place:

Back ground noise: = 58.2 dB(A) $\Delta L = (\text{tested noise}) - (\text{back ground noise}) = \underline{40.7}$ Db
(must ≥ 3 dB)

Correction for background noise $\Delta L > 10$ db, $K_{1A} = \underline{0}$ db

Measurement time per position = 20 s (≥ 15 s of time interval of a processing cycle)

Position	1	2	3	4	5
Reading (dB (A))	67.3	67.5	67.3	67.1	67.8

2. Sound pressure level (machine on full load condition)

Position	1	2	3	4	5
Reading (dB (A))	69.5	68.3	69.3	69.8	68.1

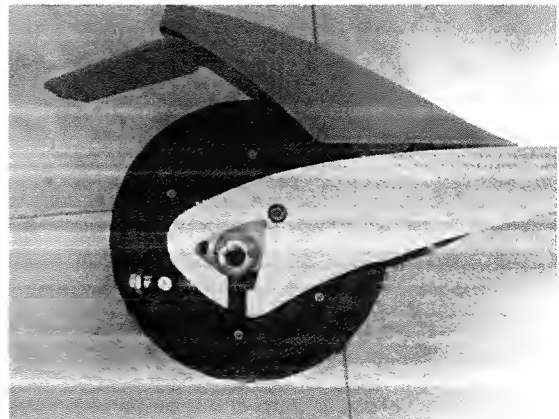
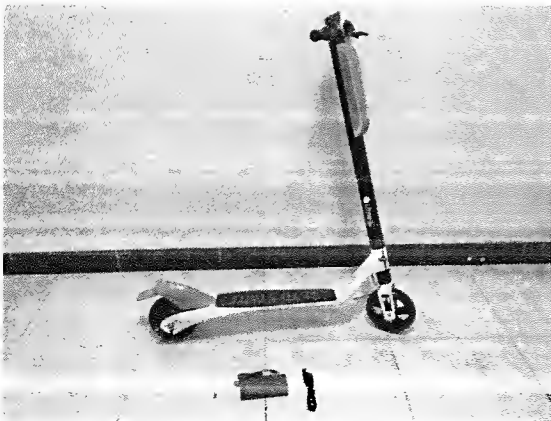
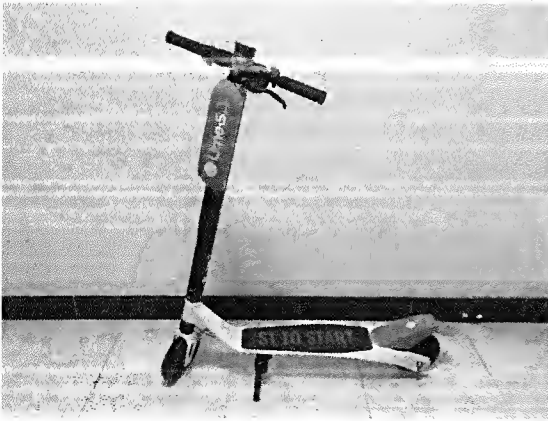
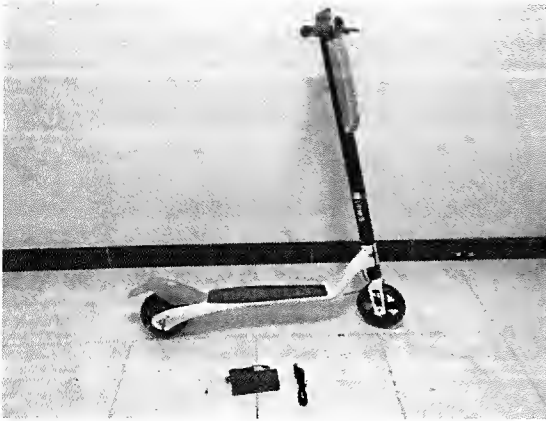
3. Sound power level (where the measuring value of sound pressure level exceeds 85 dB(A))

Position	1	2	3	4	5
Readings (dB (A))	-	-	-	-	-
Position	6	7	8	9	L _w
Readings (dB (A))	-	-	-	-	-

Annex: Technical Information

A.1 Safety pictures

Photo of Samples



EC Declaration of conformity

Council Directive 2006/42/EC on Machine Directive

2014/30/EU on Electromagnetic Compatibility

ZHEJIANG OKAI VEHICLE CO.,LTD
No. 9, Xinxing Road, Xinbi Town, Jinyun County, Zhejiang,China

Certify that the product described is in conformity with the
2006/42/EC ,2014/30/EU as amended

Product Name:

Electric Scooter

Item No:

ES09,ES09-A,ES09-B,ES09-C,ES09-D,ES09-E,ES09-F,ES09-G

The product has been assessed by the application of the following standards:


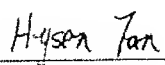
**EN ISO 12100:2010,EN 60204-1:2006+A1:2009+AC:2010,
EN 15194:2017,EN 12184:2014;
EN 61000-6-1:2007,EN 61000-6-3-2007+A1:2011;
EN 61000-3-2:2014; EN 61000-3-3:2013**

Issue place and date

Company stamp and Signature of authorized personnel

Notice

1. This test report shall be invalidation without the cachet of the testing laboratory.
2. This copied report shall be invalidation without sealed the cachet of the testing laboratory.
3. This report shall be invalidation without tester signature.
4. This altered report shall be invalidation.
5. Client shall put forward demurrer within 15 days after received report.
The testing laboratory shall refuse disposal if exceeded the time limit.
6. The test results presented in this report relate only to the object tested.

Prüfbericht - Nr.: Test Report No.:	50124069 001	Auftrags-Nr.: Order No.:	1160042913	Seite 1 von 13 Page 1 of 13
Kunden-Referenz-Nr.: Client Reference No.:	N/A	Auftragsdatum: Order date:	18.01.2018	
Auftraggeber: Client:	Neutron Holdings, INC. 2121 S El Camino Real, B100, San Mateo, CA 94403			
Prüfgegenstand: Test item:	EPAC			
Bezeichnung / Typ-Nr.: Identification / Type No.:	LIME-E BETA			
Auftrags-Inhalt: Order content:	TÜV Rheinland – EMC Service			
Prüfgrundlage: Test specification:	FCC Part 15, Subpart B:2016			
Wareneingangsdatum: Date of receipt:	22.01.2018			
Prüfmuster-Nr.: Test sample No.:	A000578607-001			
Prüfzeitraum: Testing period:	24.01.2018-26.01.2018			
Ort der Prüfung: Place of testing:	Refer to section 1.1			
cPrüflaboratorium: Testing laboratory:	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von/ tested by:		kontrolliert von/ reviewed by:		
06.02.2018	Hysen Fan/PE		07.02.2018	Tracy Zhang/TC
Datum Date	Name/Stellung Name/Position	Unterschrift Signature	Datum Date	Name/Stellung Name/Position
Sonstiges/ Other:				
The manufacturer's name and address:				
Name: JINHUA VISION INDUSTRY CO.,LTD				
Address: No.3777Kingding Road, Jiangdong Industrial Zone,Jindong District, Jinhua City, Zhejiang Province				
321000 P. R. China				
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery :		Prüfmuster vollständig und unbeschädigt Test item complete and undamaged		
*Legende:	1= Sehr gut	2 = gut	3= befriedigend	4= ausreichend
	P(ass) =entspricht o.g. Prüfgrundlage(n)	F(ail)= entspricht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	5 = mangelhaft
Legend:	1= very good	2 = good	4= sufficient	5 = poor
	P(ass) = passed a.m. test specification(s)	F(ail)= failed a.m. test specification(s)	N/A = not applicable	N/T = not tested
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.				
This test report relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any safety mark on this or similar products.				

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Model list:

No	Model	Technical parameter	Remark
1.	LIME-E BETA	Rated voltage: 36V Rated output: 250W Cut off speed: 20KM/H	Controller: 360 Motor: C579-70-002

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Test Summary

4.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

Result:

Pass

4.2 DISTURBANCE RADIATION

Result:

Pass

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2.3	INDEPENDENT OPERATION MODES	6
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1 Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC(Ningbo) Co., Ltd.

**1st Floor, Building 11, Scholar Innovation Park, No.1188
Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China.**

The used test equipment is in accordance with CISPR 16-1 series standards for measurement of radio interference.

1.1 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipments of Laboratory

No.	Equipment	Model	Serial no.	Cal. due date
1.	EMI test receiver	ESR7	101929	2018.12.06
2.	Bilog Antenna	HL562E	100940	2018.12.08

2 General Product Information

2.1 Product Function and Intended Use

The EUTs (equipment under test) are ordinary EPAC for general office or household use. They belong to Class B category according to FCC Part 15. For the further information, refer to the user's manual.

2.2 Ratings and System Details

System input voltage : Refer to page 2
Rated power : Refer to page 2

Refer to the user's manual for more information.

2.3 Independent Operation Modes

The basic operation modes are: "On" or "Off", without power regulation means.

Refer to the user's manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for more information.

2.5 Submitted Documents

Circuit diagram, PCB layout, user's manual and labels etc.

3 Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test conditions were adapted accordingly in reference to the instructions for use.

Refer to the related paragraph of this report.

3.2 Physical Configuration for Testing

Refer to the related paragraph of this report.

3.3 Test Operation and Test Software

Refer to the related paragraph of this report. No software was used.

3.4 Special Accessories and Auxiliary Equipment

None.

3.5 Countermeasures to achieve EMC Compliance

The tested sample contained noise suppression components to achieve EMC compliance. No other special measure is employed to achieve the requirement.

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4 Test Results EMISSION

4.1 Mains Terminal Continuous Disturbance Voltage

Result:	N/A
----------------	-----

Basic Standard : ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency Range : 0.15 – 30MHz
Limit : FCC Part 15, Subpart B:2016, Class B

Because the EUT is powered by built-in batteries, and cannot be connected to the mains supply. According to the standard FCC Part 15, Subpart B:2016, there is no radio disturbance limits apply with battery appliance. Therefore, no disturbance voltage test was performed.

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4.2 Disturbance Radiation

Result:	Pass
---------	------

Date of testing : 2018.01.26
Test procedure : ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency range : 30 – 1000MHz
Limits : Quasi-peak limits (3m test distance):
30-88MHz, 40dB μ V/m; 88-216MHz, 43.5dB μ V/m;
216-960MHz, 46dB μ V/m; Above 960MHz, 54.dB μ V/m.
Kind of test site : Semi-anechoic chamber
Operation modes : Normal working

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a wooden table, which is 0.8m high. The wooden table was rotated 360° around and the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

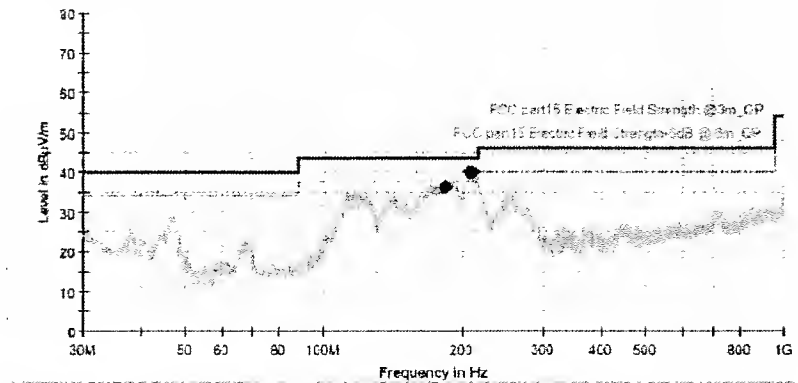
According to the clause 15.33 “Frequency range of radiated measurements” of FCC Part 15, Subpart B:2016, The highest frequency in the EUT is below 108 MHz, therefore the EUT’s upper frequency of measurement range is 1000MHz.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following figures, “♦” mean final measurement results with quasi-peak detector.

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Figure 1: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, horizontal polarization



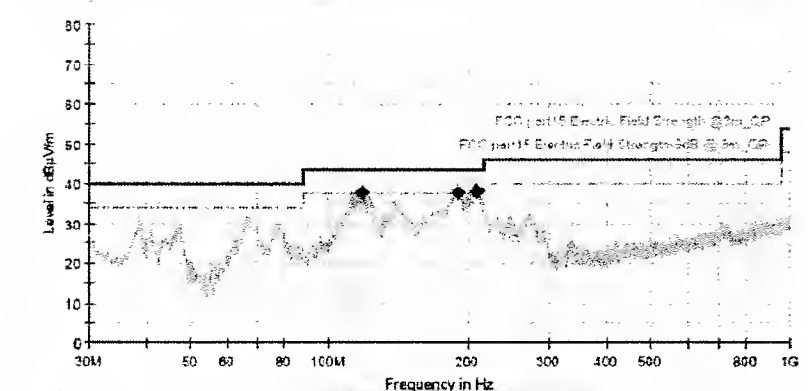
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
184.439444	36.19	43.50	7.31	1000.0	120.000	100.0	H	331.0	8.7
206.963333	40.13	43.50	3.37	1000.0	120.000	200.0	H	221.0	9.3
211.060556	40.13	43.50	3.37	1000.0	120.000	200.0	H	221.0	9.5

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Figure 2: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, vertical polarization



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
119.112778	37.71	43.50	5.79	1000.0	120.000	100.0	V	101.0	11.6
191.078333	37.03	43.50	6.47	1000.0	120.000	100.0	V	300.0	8.7
208.492778	37.98	43.50	5.52	1000.0	120.000	100.0	V	213.0	9.4

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5 Photographs of the Test Set-Up

Photograph 1: Set-up for Disturbance Radiation below 1GHz



6 List of Tables

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7 List of Figures

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Figure 2: Spectral Diagrams, Radiated Emission, 30MHz-1000MHz, vertical polarization 11

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Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	647184	Auftragsdatum: <i>Order date:</i>	15.12.2017	
Auftraggeber: <i>Client:</i>	Neutron Holdings,inc. 2121 S EL Camino Real,Suite B100,San Mateo,CA 94403			
Prüfgegenstand: <i>Test item:</i>	EPAC Bicycle			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	LIME-E BETA			
Auftrags-Inhalt: <i>Order content:</i>	Test of selected parameters			
Prüfgrundlage: <i>Test specification:</i>	CPSC 16 CFR PART 1512 Requirements for bicycles except clause 1512.16(g)-reflector test			
Wareneingangsdatum: <i>Date of receipt:</i>	13.12.2017			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000667992-001			
Prüfzeitraum: <i>Testing period:</i>	15.12.2017 – 20.12.2017			
Ort der Prüfung: <i>Place of testing:</i>	Kunshan			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd. Kunshan Branch			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
08.01.2018	Rain Wei / PE	08.01.2018	Simon Huang / Reviewer	
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
				
Sonstiges / Other :				
1. According to applicant's request, the tests in clause 1512.16(g) were not performed.				
2. Manufacturer: JINHUA VISION INDUSTRY CO.,LTD.				
3. Manufacturer Address: No.3777Jingding Road,Jiangdong Industrial Zone,Jindong District,Jinhua City, Zhejiang Province,China.				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = nicht getestet P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet				
Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = not tested P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.				
<i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel <i>Test equipment</i>	Prüfmittel-Nr. / ID-Nr. <i>Equipment No. / ID-No.</i>	Nächste Kalibrierung <i>Next calibration</i>
Standard servo type universal testing machine	GC-KS-Z015	29.08.2018
Drive system static load testing machine	GC-KS-Z016	29.08.2018
Braking performance testing machine	GC-KS-Z030	29.08.2018
Handlebar assembly/Seat assembly clamping performance tester	GC-KS-Z001	29.08.2018
Wheel/frame(fork) retention testing machine	GC-KS-Z003	29.08.2018
Rim-tire retention test machine	GC-KS-Z044	29.08.2018
Torque Wrenc	GC-KS-R002	29.08.2018
Steel ruler	GC-KS-L003	29.08.2018
Digital caliper	GC-KS-L006	29.08.2018
Digital protractor	GC-KS-L013	29.08.2018
Electron-stopwatch	GC-KS-H001	29.08.2018
Tire barometer	GC-KS-P002	29.08.2018
cleated wood track	GC-KS-Z018	29.08.2018
Push-Pull Gauge-500N	GC-KS-P004	29.08.2018
Grip dimension gauge	GC-KS-L018	29.08.2018
Electronic balance	GC-KS-L022	29.08.2018

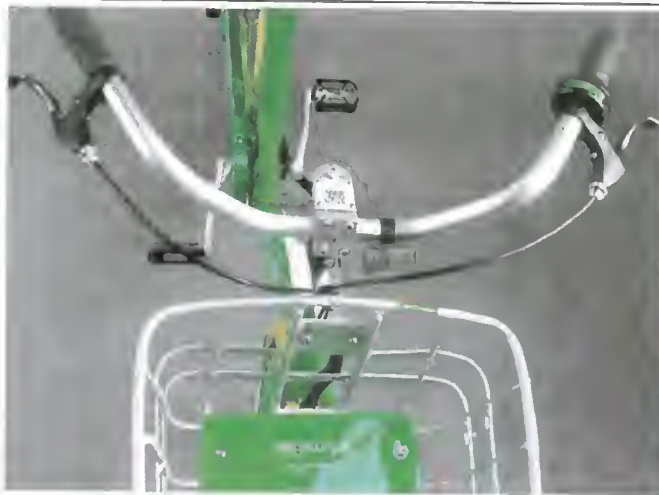
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Produktbeschreibung
Product description

1	Produktdetails <i>Product details</i>	EPAC Bicycle.
2	Maße / Gewicht <i>Dimensions / Weight</i>	Weight: 32.10kg.
3	Bedienelemente <i>Operating elements</i>	N/A.
4	Ausstattung / Zubehör <i>Equipment / Accessories</i>	N/A.
5	Verwendete Materialien <i>Used materials</i>	Frame: Aluminium Alloy.
6	Sonstiges <i>Other</i>	Maximum saddle height: 1011mm; Tyre size: 26*1.5 inch.

1



2



3



4



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Absatz	CPSC 16 CFR PART 1512	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation
1512.1	Scope		
1512.2	Definitions		P
1512.3	Requirements in general		P
1512.4	Mechanical requirements		
(a)	Assembly		P
(b)	Sharp edges		P
(c)	Integrity	Tested with positive results; No foot-brake was fitted.	P
(d)	Attachment hardware		P
(e)-(f)	[Reserved]		
(g)	Excluded area	Checked ok.	P
(h)	[Reserved]		
(i)	Control cable ends	Cabled ends were fitted with protective caps; Not removed with a pulling force of 8.9N.	P
(j)	Control cable abrasion	Checked ok.	P
1512.5	Requirements for braking system		
(a)	Braking system	Front brake: Roller brake; Rear brake: Expansion brake.	P
(b)	Handbrakes	Tested with positive results per 1512.18(d)(2), and 1512.18(d)(2)(iii).	P
(b)(1)	Stopping distance	Equivalent ground speed: 17.73km/h; Specified speed: 16km/h; Corrected braking distance: 2.57m.	P
(b)(2)	Hand lever access	Checked ok.	P
(b)(3)	Grip dimension	Checked ok.	P
(b)(4)	Attachment	Thread locking compound was used for positive locking.	P
(b)(5)	Operating force	Checked ok.	P
(b)(6)	Pad and pad holders	Checked ok.	P
(b)(7)	[Reserved]		
(b)(8)	Hand lever location	Right lever controls rear brake; Left lever controls front brake.	P
(b)(9)	Hand lever extensions	Not hand lever extensions were fitted.	N/A
(c)	Footbrakes	Not footbrake was fitted.	N/A
(c)(1)	Stopping distance		N/A
(c)(2)	Operating force		N/A
(c)(3)	Crank differential		N/A
(c)(4)	Independent operation		N/A

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Absatz Clause	CPSC 16 CFR PART 1512 Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse - Bemerkungen Measuring results - Remarks	Bewertung Evaluation
(d)	Footbrakes and handbrakes in combination		N/A
(e)	Sidewalk bicycles	Not sidewalk bicycles.	N/A
(e)(1)	Sidewalk bicycles shall not have handbrakes only.		N/A
(e)(2)	Sidewalk bicycles with a seat height of 560 mm (22 in) or greater (with seat height adjusted to its lowest position)		N/A
(e)(3)	Sidewalk bicycles with a seat height less than 560 mm (22 in) (with seat height adjusted to its lowest position) and not equipped with a brake		N/A
1512.6	Requirements for steering system		
(a)	Handlebar stem insertion mark	Diameter: 25.36mm; Position of the mark: 74.49mm.	P
(b)	Handlebar stem strength	Tested with positive results.	P
(c)	Handlebar	Height differential: 235mm<406mm.	P
(d)	Handlebar ends	Handgrips fitted.	P
(e)	Handlebar and clamps		P
1512.7	Requirements for pedals		
(a)	Construction	Tread surfaces on the top and bottom surfaces of the pedal.	P
(b)	Toe clips	Not intended to be used with toe clips.	N/A
(c)	Pedal reflectors	Pedal reflectors were fitted.	P
1512.8	Requirements for drive chain	Breaking force: 9130N>8010N.	P
1512.9	Requirements for protective guards		
(a)	Chain guard	Checked ok.	P
(b)	Derailleur guard		N/A
1512.10	Requirements for tires		N/A
1512.11	Requirements for wheels		
(a)	Spokes		P
(b)	Alignment		P
(c)	Rims	Tested with positive results.	P
1512.12	Requirements for wheel hubs		
(a)	Locking devices		P
(a)(1)	Rear wheels		P
(a)(2)	Front wheels	Tightening torque: 30N.m; Release torque: 20N.m.	P
(b)	Quick-release devices	No quick-release device was used for wheel hubs clamping.	N/A
(c)	Front hubs		P

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Absatz Clause	CPSC 16 CFR PART 1512 Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse - Bemerkungen Measuring results - Remarks	Bewertung Evaluation
------------------	---	---	-------------------------

1512.1 3	Requirements for front fork	Tested with positive results.	P
1512.1 4	Requirements for fork and frame assembly	Tested with positive results.	P
1512.1 5	Requirements for seat		
(a)	Seat limitations		P
(b)	Seat post	Diameter: 33.84mm; Permanent Device of the mark: 86.67mm.	P
(c)	Adjustment clamps		P
1512.1 6	Requirements for reflectors		
(a)	Front, rear, and pedal reflectors	Front: white; Rear: red; pedal : amber.	P
(b)	Side reflectors (Retro-reflective tire sidewalls or, alternatively, reflectors mounted on the spokes of each wheel, or, for non- caliper rim brake bicycles, retro-reflective wheel rims.)	Side:white; Side reflectors mounted on the spokes of each wheel.	P
(c)	Front reflector	Reflector tests in 1512.18(n) not performed.	P
(d)	Rear reflector	Reflector tests in 1512.18(n) not performed.	P
(e)	Pedal reflectors	Checked Ok.	P
(f)	Side reflectors (affixed to the wheel spokes)	Checked Ok. Side: white.	P
(g)	Reflector tests	See "other" on page 1.	N/T
(h)	Retro-reflective tire sidewalls		N/A
(i)	Retro-reflective rims		N/A
1512.1 7	Other requirements		
(a)	Road test		P
(b)	Sidewalk bicycle proof test	Not sidewalk bicycles.	N/A
(c)	Ground clearance	Right side: 27.4°	P
(d)	Toe clearance	Left side: 208mm; Right side: 206mm.	P

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Absatz	CPSC 16 CFR PART 1512	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

1512.1 8	Tests and test procedures		
1512.1 9	Instructions and labeling	a) N/A; b) N/A; c) N/A; d) Reserved; e) Frame number: IMEI:3529480701228 37 was confirmed by client.	P
1512.2 0	Separability		

*** End of test report ***

This document is one of three forms required for a complete license application.

Please submit signed and completed documents by email to DocklessMobility@AustinTexas.gov.



City of Austin

Austin Transportation Department, Mobility Services Division
1111 Rio Grande St, Austin, TX 78701

[Reset Form](#)

DOCKLESS MOBILITY LICENSE APPLICATION

APPLICATION TYPE (check one): ☒ New ☐ Renewal ☐ Supplement (if adding units to a licensed system)

APPLICANT INFORMATION

The following information must be provided for the applicant, each officer, director, partner, and any other person who will participate in the business decisions of or who has the authority to enter contracts on behalf of this dockless mobility company. This information is to be provided on a separate page and attached to the application.

Applicant Name:

Sam Sadle

City:

San Mateo

State:

California

ZIP Code:

94403

Phone:

(202) 641-6162

E-mail:

PARENT COMPANY

Business Name:

Neutron Holdings, Inc.

Business Structure (describe):

Privately Held Corporation

Address:

2121 South El Camino Real B-100

City:

San Mateo

State:

California

ZIP Code:

94403

Contact Name:

Sam Sadle

Phone:

(202) 641-6162

E-mail:

BUSINESS INFORMATION

Business Name/DBA:

Lime

Sales Tax Number:

814870517

Business Structure (circle one): ☒ Corporation ☐ Limited Liability Company ☐ Partnership ☐ Sole Proprietorship

☐ Other (describe):

Address:

3913 Odd Lane

City:

Austin

State:

TX

ZIP Code:

78744

Phone:

(202) 641-6162

E-mail:

PAST PERFORMANCE

Have you held a permit issued by the City of Austin and/or any adjacent cities or counties that has been revoked? ☐ Yes ☒ No If you answered yes, attach additional sheets explaining why.

Has your company been fined or had property impounded by the City of Austin and/or any adjacent cities or counties? ☒ Yes ☐ No If you answered yes, attach additional sheets explaining why.

Does your company have any outstanding fees or fines owed to the City of Austin and/or any adjacent cities or counties? ☐ Yes ☒ No

If yes, in what jurisdiction(s)?

SERVICE AREA AND SIZE OF FLEET

FLEET SIZE: 500 Bikes (write in total number of units) ☒ Initial Fleet ☐ Additional Units

PLEASE INCLUDE THE FOLLOWING ITEMS WHEN SUBMITTING THIS APPLICATION:

1. Proof of insurance documentation that names the City of Austin as an additional insured. (See Terms and Conditions of License for requirements).
2. Images and description of unit and mobile application. (See Dockless Mobility Technology Rules Section 2, Dockless Mobility Units and Section 6, Operations and Customer Service)
3. A sample of the unit to be used under this program for inspection by ATD. (See Dockless Mobility Technology Rules Section 2, Dockless Mobility Units)
4. Description of pricing structure, rates, and method(s) of communication to the customer. (See Dockless Mobility Technology Rules Section 6, Operations and Customer Service)
5. A Unit Inventory List in an electronic spreadsheet listing the serial number of each unit. (See Dockless Mobility Technology Rules Section 2, Dockless Mobility Units, Part C)
6. As part of the applicant's Citywide Unit Placement Plan
 - a. A Safety Response Plan detailing how safety and maintenance issues will be identified and addressed. (See Dockless Mobility Technology Rules Section 4, Safety)
 - b. An ESRI ArcGIS shapefile specifying the geographic area of interest, if seeking supplemental units above the 500 units authorized under the initial license application. (See Dockless Mobility Technology Rules Section 3, Service Area and Size of Fleet, Part B(1))
 - c. A Marketing and Outreach Plan. (See Dockless Mobility Technology Rules Section 6, Operations and Customer Service, Part F)
 - d. A Maintenance, Cleaning, Repair and Waste Management Plan. (See Dockless Mobility Technology Rules Section 6, Operations and Customer Service, Part G)
7. Access to a documented web-based application programming interface (API) capable of providing fleet information and anonymized data for each trip. (See Dockless Mobility Technology Rules Section 7, Data Reporting and Sharing, Part F, H)
8. All copies of the terms of service, including the privacy policy, the End User License Agreement (EULA) and all versions of this information available when accessing the service from a smart phone as well as the operator's website. (See Dockless Mobility Technology Rules Section 7, Data Reporting and Sharing, Part D)
9. Copy of the Performance bond listing the City of Austin. (See Dockless Mobility Technology Rules Section 8, Insurance, Performance Bond and Fees, Part B)
10. Certificate of conformance to 16 CFR part 1512 for each import shipment of bicycles, and the equivalent for each shipment of scooters. (See Dockless Mobility Technology Rules Section 2, Dockless Mobility Units, Part I)
11. Test results from a qualified independent lab demonstrating that each model bicycle put into service meets or exceeds ISO 4210: Safety Requirements for City and Trekking Bicycles, and the equivalent for each model scooter. (See Dockless Mobility Technology Rules Section 7, Data Reporting and Sharing, Part F, H)
12. If operating electric-assist units, certification from a qualified independent testing laboratory that the make and model of electric bicycles and scooters used employ an electric motor of less than 750 watts (1 hp), whose maximum speed on a paved level surface, when powered solely by such a motor while ridden by an operator who weighs 170 pounds, is less than 20 mph. (See Dockless Mobility Technology Rules Section 7, Data Reporting and Sharing, Part K)

Finish and Save Form

This document is one of three forms required for a complete license application.

Please submit signed and completed documents by email to DocklessMobility@AustinTexas.gov.



City of Austin

Austin Transportation Department, Mobility Services Division

1111 Rio Grande St, Austin, TX 78701

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If yes, in what jurisdiction(s)?

SERVICE AREA AND SIZE OF FLEET**FLEET SIZE:** 500 Scooters (write in total number of units) ☒ Initial Fleet ☐ Additional Units**PLEASE INCLUDE THE FOLLOWING ITEMS WHEN SUBMITTING THIS APPLICATION:**

1. Proof of insurance documentation that names the City of Austin as an additional insured. (See Terms and Conditions of License for requirements).
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Finish and Save Form

LICENSE SURETY BOND

THE STATE OF TEXAS
COUNTY OF TRAVIS

KNOWS ALL BY THESE PRESENTS:
BOND NO. [REDACTED]

PRINCIPAL, Neutron Holdings, Inc., (check one) a ☐ corporation ☒ limited liability ☐ partnership ☐ sole proprietorship, engaged in the commercial use of sidewalks or City public right of way for the display, sale, lease or rental of dockless transportation services within the City of Austin, Texas ("CITY"), AND

SURETY, RLI Insurance Company, a solvent company authorized under the laws of the State of Texas to act as surety on bonds for principals, agree to bind ourselves, our successors and assigns, jointly and severally, unto the CITY and to all persons who may suffer injury from any work or service undertaken by PRINCIPAL hereunder, as OBLIGEEs, in the sum of One Hundred Thousand & No/100
DOLLARS (\$ 100,000.00).

PRINCIPAL and SURETY are bound to pay this amount to OBLIGEEs only if PRINCIPAL fails to fulfill the following obligations:

- a. PRINCIPAL shall indemnify and hold harmless the CITY and all other persons and entities from all claims for damages to any person or property, including all costs and expenses, arising out of PRINCIPAL's use of the right-of-way within the CITY;
- b. PRINCIPAL shall repair any damage and correct any defect to the right-of-way, caused by PRINCIPAL's use of the right-of-way and shall warrant such work for a period of one year following completion of same;
- c. PRINCIPAL shall remove or reduce in concentration dockless mobility units that the director has determined, that cause or significantly contribute to sidewalk congestion or make access to abutting property hazardous;
- d. PRINCIPAL shall remove mobility units that the director deems unsafe for use due to defect or non-conformance with Chapter 14-9 or the applicable rules;
- d. PRINCIPAL shall pay all costs, fees, charges, fines, assessments or judgments levied against or incurred by PRINCIPAL for the removal and storage of dockless mobility units, which may become due to the CITY or to other persons or entities as a result of the activities undertaken hereunder by PRINCIPAL;
- e. PRINCIPAL, its agents and employees shall perform all work in strict compliance with all applicable laws, ordinances, resolutions, rules and regulations; and
- f. PRINCIPAL and SURETY shall not violate any of the terms of this bond

If this bond is canceled or the coverage of this bond is restricted for any reason, SURETY shall immediately deliver written notice of such to the CITY and to the Director of the Austin Transportation Department. The cancellation or restriction becomes effective after thirty (30) working days from the date the CITY receives the notice. Cancellation or restriction does not affect SURETY'S liability on any transaction begun before the effective date of the cancellation or restriction. In the event of cancellation or restriction, PRINCIPAL will be suspended from all rights and privileges and no license will be issued to PRINCIPAL under Chapter 14-9 of the City Code of Austin, as applicable. This suspension remains effective until the bond coverage required by the applicable rule or section of code is fully restored.

The bond will be binding upon PRINCIPAL and SURETY from the 23rd day of May 2018, until midnight, the 22nd day of May 2019. Signed, sealed, and executed this 23rd day of May, 2018.

PRINCIPAL

BY: _____
(Signature)
Name: Neutron Holdings, Inc.
Title: _____
Address: 22 South El Camino Real, Suite B 00
Address: San Mateo, CA 94403
Phone: (650) 667-0722

SURETY

BY: _____
(Signature)
Name: RLI Insurance Company
Title: Attorney-in-Fact
Address: 9025 N. Lindbergh Dr.
Address: Peoria, IL 61615
Phone: (309) 692-1000



City of Austin

Austin Transportation Department, Mobility Services
1111 Rio Grande Street, Austin, Texas 78701

CITYWIDE LICENSE TERMS AND CONDITIONS

1. INTRODUCTION

- 1.1 Agreement:** These Terms and Conditions are made in conjunction with the Director's Rules and any other agreement between the Licensee and the City of Austin. Together, these documents record our agreement in relation to the use of City of Austin right of way.
- 1.2 Priority:** If there is any inconsistency between these Terms and Conditions and/or any other agreements, the Terms and Conditions shall prevail in that order, over the Rules.

2. INSURANCE REQUIREMENTS

- 2.1** Business Automobile Liability Insurance with a minimum combined single limit of \$500,000 per occurrence for bodily injury and property damage for all owned, non-owned and hired vehicles. The policy shall contain the following endorsements:
- A. Waiver of Subrogation in favor of the City of Austin, endorsement CA 0444, or equivalent coverage
 - B. 30 day Notice of Cancellation in favor of the City of Austin, endorsement CA 0244, or equivalent coverage
 - C. City of Austin listed as additional Insured, endorsement CA 2048, or equivalent coverage
- 2.2** Commercial General Liability Insurance with a minimum bodily injury and property damage per occurrence limit of \$500,000 for coverages A (bodily injury and property damage) & B (personal and advertising injury). The policy shall contain the follow provisions:
Products and Completed Operations with a minimum limit of \$500,000
Explosion, Collapse, and Underground (XCU) coverage
Independent Contractors coverage
- 2.3** The policy shall be endorsed and certificates shall reflect the following:
City of Austin listed as additional insured, Endorsement CG 2010 or equivalent.
- A. Waiver of Subrogation in favor of the City of Austin, Endorsement CG 2404 or equivalent.
 - B. 30 day Notice of Cancellation in favor of the City of Austin, Endorsement CG 0205 or equivalent.
- 2.4** Certificate Holder and ALL ENDORSEMENTS naming the CITY as Additional Insured, granting Waivers, and providing Notice of Cancellation, shall indicate:
City of Austin, ATTN: Mobility Services
P.O. Box 1088
Austin, Texas 78767

2.5 The REQUESTOR'S insurance coverage is to be written by companies licensed to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best Ratings of B+ VII or better. The "other" insurance clause shall not apply to the CITY where the CITY is an additional insured shown on any policy. It is intended that policies required in the AGREEMENT, covering both the CITY and REQUESTOR, shall be considered primary coverage as applicable. If coverage is underwritten on a claims made basis, the retroactive date shall be coincident with the date of the AGREEMENT and the certificate of insurance shall state that the coverage is claims made and the retroactive date shall be shown. The REQUESTOR shall provide the CITY annually with a certificate of insurance as evidence of such insurance. If insurance policies are not written for amounts specified above, the REQUESTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage. The REQUESTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the AGREEMENT or as required in the AGREEMENT. The REQUESTOR shall be responsible for premiums, deductibles, self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the certificate of insurance. The CITY reserves the right to review the insurance requirements set forth during the effective period of this AGREEMENT and to make reasonable adjustments to insurance coverage, limits and exclusions when deemed necessary and prudent by the City based upon changes in statutory law, court decisions, and the claims history of their industry or financial condition of the insurance company as well as the REQUESTOR. The insurance coverages required are required minimums and are not intended to limit the responsibility or liability of the REQUESTOR.

3. LICENSE PAYMENT

3.1 Initial Payment: Prior to issuance of license(s), the applicant shall pay the appropriate non-refundable fees, as established by ordinance.

3.2 Per Unit Fee: The licensee shall pay a fee per unit.

4. LICENSE TERM

4.1 Initial Term: From the date of issuance, the license shall be valid for no longer than six (6) months.

4.2 Renewal: Upon expiration of the Initial Term, the License will automatically renew for six (6) months with the same terms and conditions, upon payment of applicable fees, unless either the City or Licensee chooses not to renew. If the City chooses not to renew this Agreement, the City shall notify the Licensee of non-renewal at least two (2) weeks prior to the expiration of the then-current term. If the Licensee chooses not to renew this Agreement, the Licensee shall notify the City of non-renewal at least two (2) weeks prior to the expiration of the then-current term.

4.3 Termination for Cause by City: The City may terminate a license, based on the Licensee's inability to cure such defaults listed below. The City's right to terminate this Agreement for

Licensee's default is cumulative of all its rights and remedies which exist now or in the future. Default by Licensee includes, but is not limited to:

- A. Failure of the Licensee to comply with any requirement in City Code or Rules.
- B. Licensee becomes insolvent;

4.4. Termination by Licensee: The licensee may terminate a license at any given time, by providing the City a minimum of a two (2) week notice. Upon termination, the licensee shall inform their customers of the change and remove the units within ten (10) business days.

5. LICENSE REVOCATION

5.1 Initial Term: From the date of issuance, the license shall be valid for no longer than six (6) months.

6. LICENSEE DEBT

Licensee shall comply with the City Code and Director Rules, as amended from time to time. If the City becomes aware that the Licensee owes any money to the City or any related entity for Ad Valorem Taxes on real or personal property located within the boundaries of the City ("Debt"), it shall notify Licensee in writing. If Licensee does not pay the debt within thirty (30) days of such notification, the Director reserves the right to terminate the license.

7. EXCLUSION

This Program does not regulate or authorize operation at the Austin Bergstrom International Airport (ABIA). Such operation shall be with the approval of the ABIA Director and under such terms and conditions as the ABIA Director shall prescribe, including assessment of a fee.

8. NO RECOURSE

No recourse shall be had against any elected official, director, officer, attorney, agent, or employee of either of the Parties, whether in office on the effective date of this license or after such date, for any claim based upon this agreement.

9. NO JOINT VENTURE, PARTNERSHIP, AGENCY

Nothing in this license will be construed in any form or manner to establish a partnership, joint venture or agency, express or implied, nor any employer – employee or borrowed servant relationship by and among the parties.

10. NO PRIVATE RIGHTS

Nothing in this license will be construed in any form or manner to convey any private property right in, or to, the use of any street or public right-of-way. All permissions granted by this agreement shall be subject to the superior right of the public to the safe and orderly movement of people and traffic.

11. MISCELLANEOUS PROVISIONS

- 11.1** This agreement constitutes the entire agreement between the Parties with respect to the subject matter hereof. Any previous agreement, assertion, statement, understanding or other commitment before the date of this contract, whether written or oral, shall have no force or effect. No agreement, assertion, statement, understanding, or other commitment during the term of this Program, or after the term of this Program, shall have any legal force or effect unless properly executed in writing by the parties.
- 11.2** This Program is made, and shall be construed and interpreted under the laws of the State of Texas and venue for any lawsuit concerning this Program shall lie in the City of Austin, Travis County, Texas.
- 11.3** Regardless of the actual drafter of this agreement, this agreement shall, in the event of any dispute over its meaning or application, be interpreted fairly and reasonably, and neither more strongly for or against any party.
- 11.4** All official communications and notices required to be made under this Program shall be deemed made if sent, postage prepaid to the parties at the attention of the signatories hereto.
- 11.5** The Parties bind themselves and their successors in interest, assigns and legals to this Program.

12. INDEMNITY

Lime SHALL DEFEND, INDEMNIFY, AND HOLD HARMLESS CITY, ITS OFFICERS, APPOINTED OR ELECTED OFFICIALS, EMPLOYEES, AGENTS, REPRESENTATIVES, SUCCESSORS AND ASSIGNS (INDEMNIFIED PARTIES), AGAINST ALL COSTS, EXPENSES (INCLUDING REASONABLE ATTORNEYS' FEES, EXPENSES, AND COURT COSTS), LIABILITIES, DAMAGES, CLAIMS, SUITS, ACTIONS, AND CAUSES OF ACTIONS (CLAIMS), TO THE EXTENT ARISING, DIRECTLY OR INDIRECTLY, OUT OF (A) A BREACH OF THIS AGREEMENT OR VIOLATION OF LAW BY Lime , ITS OFFICERS, AGENTS, EMPLOYEES, Lime 'S SUB-ENTITIES, SUCCESSORS OR ASSIGNS, (Lime PARTIES), (B) A FALSE REPRESENTATION OR WARRANTY MADE BY THE Lime PARTIES IN THIS AGREEMENT OR IN Lime 'S PROPOSAL, (C) THE NEGLIGENCE, WILLFUL MISCONDUCT, OR BREACH OF A STANDARD OF STRICT LIABILITY BY THE Lime PARTIES IN CONNECTION WITH THIS AGREEMENT. CLAIMS TO BE INDEMNIFIED UNDER THIS ARTICLE INCLUDE CLAIMS FOR BODILY INJURY OR DEATH, OCCUPATIONAL ILLNESS OR DISEASE, LOSS OF SERVICES WAGES OR INCOME, DAMAGE DESTRUCTION OR LOSS OF USE OF PROPERTY, AND WORKERS' COMPENSATION CLAIMS. Lime 'S OBLIGATIONS UNDER THIS ARTICLE ARE NOT EXCUSED IN THE EVENT A CLAIM IS CAUSED IN PART BY THE ALLEGED NEGLIGENCE OR WILLFUL MISCONDUCT OF THE INDEMNIFIED PARTIES.

City shall give Lime written notice of a Claim asserted against an Indemnified Party. Lime shall assume on behalf of the Indemnified Parties and conduct with due diligence and in good faith the defense of all Claims against the Indemnified Parties. The Indemnified Parties shall have the right (but not the obligation) to participate in the defense of any claim or litigation with attorneys of their own selection without relieving Lime of any obligations in this agreement. In no event may Lime admit liability on the part of an Indemnified Party without the written consent of City Attorney.

Maintenance of the insurance required under this Agreement shall not limit Lime's obligations under this Article. Lime shall require all subcontractors to indemnify City as provided in this Article.

BY SIGNING BELOW, I AGREE TO ALL OF THE TERMS OUTLINED ABOVE.

I DECLARE THAT THE INFORMATION PROVIDED IN THIS APPLICATION IS TRUE AND THAT I HAVE READ THE CITY OF AUSTIN CODE SECTION 14-9-1 THROUGH 14-9-23, AND I UNDERSTAND ALL CONDITIONS OF THIS APPLICATION AS SET FORTH HEREIN AND THE CITY CODE.

PRINT NAME AND TITLE

SIGNATURE OF APPLICANT
(MUST SIGN IN THE PRESENCE OF NOTARY)

THE PERSON KNOWN TO ME TO BE THE ABOVE SIGNED APPLICANT IS DULY SWORN BY ME AND STATES UNDER OATH THAT HE/SHE HAS READ THIS APPLICATION AND THAT ALL FACTS THEREIN SET FORTH ARE TRUE AND CORRECT.

SWORN TO ME ON THIS, THE _____ DAY OF _____, 20____

STATE OF TEXAS, TRAVIS COUNTY NOTARY PUBLIC SIGNATURE

Additional applicants for Lime permit application
(Note: applies to both scooter and e-assist applications)

Applicant: Toby Sun, CEO
City: San Mateo
State: California
Zip Code: 94403
Phone: (510) 710-2684
Email: [REDACTED]

Applicant: Andrew Savage, VP of Strategic Development
City: San Mateo
State: California
Zip Code: 94403
Phone: (802) 793-9793
Email: [REDACTED]



Lime
Shared Mobility Services
Permit Application
Austin, Texas

May 23, 2018

May 23, 2018

Laura Dierenfield

City of Austin

Active Transportation Program Manager

3701 Lake Austin Boulevard

Austin, TX 78703

At Lime, our mission is to provide last mile transportation solutions, helping residents seamlessly transit throughout their neighborhoods and across the community. Moving the nearly 950,000 residents Austin is no easy feat, but we are eager to help you to reach and exceed your transportation and sustainability goals. At no cost to the city, we are ready and able to provide Austin residents a convenient and easy to use mobility system that that is an efficient, healthy, and affordable way to get around town. We can help you take the leap to becoming a smarter, more mobile city.

Lime is the nation's largest dock free mobility company and provide transportation solutions to more than 60 communities across the country. We are extremely proud of our track record of partnering with local officials to build the future of urban transportation from South Bend to South San Francisco, from Imperial Beach, California to Miami Shores, Florida. Further, we take great pride in our relentless focus on the safety and quality of our bikes and scooters as well as our commitment to operations, which is best in the industry.

Lime is focused on serving communities across the country and our team is committed to the notion of shared mobility for all Americans. Thank you for the opportunity to let us serve Austin. We look forward to the opportunity to answer any questions, and eagerly await the opportunity to provide transportation solutions to your residents.

Warmly,

Toby Sun

CEO and Co Founder

Sam Sadle *(Primary City of Austin Contact)*

Director of Strategic Development, Texas

[REDACTED]
(202) 64 6 62

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About Lime in Austin

Lime was founded on a simple premise: how do we help American communities thrive? Here at Lime we answer that question by providing a new, cutting edge solution to the first and last mile transportation problem — helping people move around their communities in an affordable, convenient, and sustainable manner. We are here to empower residents, workers, and visitors to Austin to get where they need to go.

Founded in 2017, Lime is a minority owned American company (EIN: 81-4870517) headquartered in San Mateo, California. Our mission is to revolutionize mobility in Austin by providing residents with a safe, convenient, affordable, and viable transportation option that advances sustainability. We achieve these goals by utilizing modern mobile and wireless technologies to make mobility universally available and affordable with a subsidy free network that is flexible and customizable, does not displace or occupy existing infrastructure, and can be easily moved in the case of special events, weather, or other public space priorities.

Backed by top tier venture capital firms, we are able to make our cutting edge smart bicycles, e assist bikes, and scooters widely available at no cost to the City of Austin. More than that, through our existing partnerships with the Austin area organizations, we actively working to embed ourselves into the community, in order to effectively, efficiently, and empathetically responding to on the ground conditions and resident demands. Here at Lime, we seek to be a partner for the City of Austin for the long run. Having recently announced an additional \$70 million in funding, we have the resources necessary to sustainably invest in our technology, operations, and team for years to come.

We are not new to Austin and have spent the past months building relationships across the city and region. We look forward to partnering with local organizations below on a variety of efforts, including operations staffing, public outreach, transportation planning, and community engagement, and identifying locations to stage bikes and scooters.

Pricing and Payment

Lime “smart bikes” are the most affordable way to get around, period. The system itself is completely free of charge to the City of Austin. Members of the community pay only \$ for a 30 minute ride, regardless of distance. If a rider goes over time, they are simply charged the same flat fee for another 30 minute ride. Local university students, faculty and staff pay half price for use of our traditional LimeBike pedal bikes (anyone with a valid “.edu” email address). We also have monthly plans 00 rides for \$29.95. Our national data shows that an average of 90 percent of all rides are under 30 minutes, with most people riding about .3 miles.

Lime’s “Lime E” e assist bikes and “Lime S” scooters operate under a different payment structure. In the case of these products, users pay \$ to unlock the e bike or scooter and then are charged \$ per 0 minutes of use. All pricing information is indicated both in the smart phone app and directly on the mobility devices themselves.

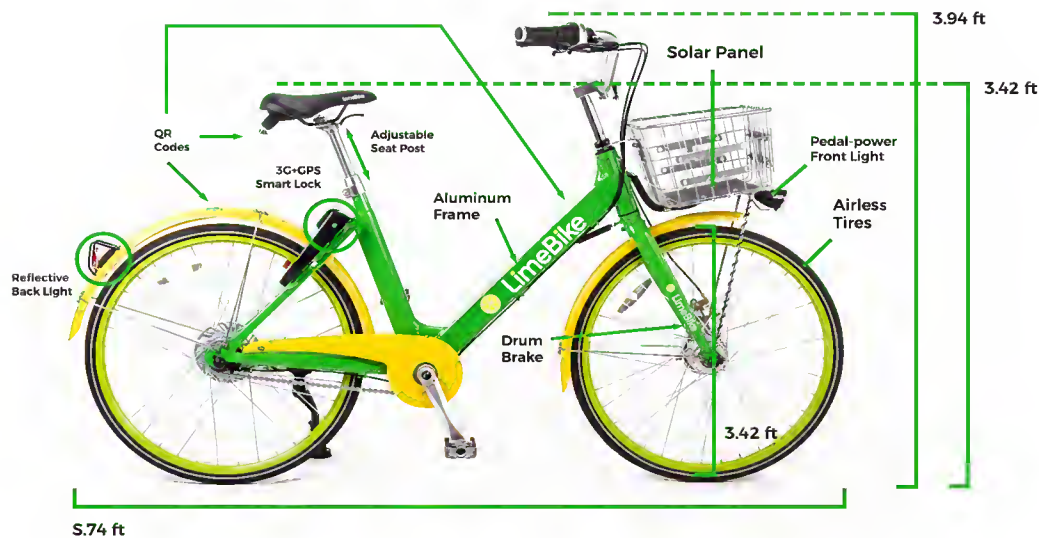
At Lime, we believe that access to transportation is essential and we work diligently to ensure that everyone has access to LimeBike regardless of financial or technical limitations. To meet this challenge, we have developed the Lime Access program for low income community members, who can sign up for discounted memberships. Low income community members can sign up for an account through our Lime Access team (https://www.limebike.com/community_impact). All they have to do is provide evidence of enrollment in a government assistance program (TANF, SNAP, or other program) and they will be charged at a rate of \$5 for 00 rides on LimeBike.

Members of the Lime Access program without access to a smartphone can text a special 24 hour customer support number and to unlock a bike. Finally, unbanked community members can also access LimeBike through the Pay Near Me network.

LimeBike

LimeBike is a smart bike designed in California to provide robust bike sharing networks without kiosk infrastructure. Our GPS enabled bike technology allows riders to locate and unlock any LimeBike using our mobile app and then simply lock the bike in any commonly accepted parking spot. Each bike is equipped with a smartlock which disables the bike when locked, and can be unlocked by scanning the QR code, keying in the plate number, or remote unlocking. The brightly colored bikes feature:

- A solar powered smart lock that can be unlocked from the LimeBike app;
- Run flat (puncture proof, solid) tires;
- An all aluminum frame which is strong, rust resistant, and easily recyclable;
- An adjustable ergonomic seat for maximum durability and comfort;
- A basket with room for a grocery bag, book bag, or other personal items; and
- Front and rear lights and reflective markings to contribute to rider safety and convenience.



LimeBike's design and specifications are continually updated based on user feedback and testing to create the best riding experience. LimeBike meets the standards outlined in the Code of Federal Regulations (CFR) under Title 6, Chapter II, Subchapter C, Part 5.2 Requirements for Bicycles. Additionally, permitted systems shall meet the safety standards outlined in ISO 43.50 Cycles, subsection 42.0 and have been independently tested and meet the safety standards of renowned testing company SGS Global.

Lime-E

As part of our efforts to provide comprehensive mobility solutions, in Austin we anticipate deploying Lime E electric assist bikes and Lime S electric assist scooters as part of our mobility fleet. Lime E "e assist" bikes have a small electric motor to assist a rider's pedaling. Our industry leading torque sensing technology aids a rider such that as he or she expends more effort pedaling the e assist automatically activates to propel the rider proportionally more than their efforts. Our Operations team will remotely monitor battery life and conduct battery swaps regularly to optimize the fleet.

E-assist pedal bike

- Brand name: Lime E
- Dimension: 5.74ft long (similar to regular LimeBike)
- Max range: 62 miles depending on usage
- Max speed: 4.8 MPH
- Motor: 250w
- Gear: Single Speed
- Weight: 60 pounds
- Battery: lithium battery, swappable
- Battery charging time: ~ 4 hrs



Lime-S

E-Assist Scooter

- Brand name: Lime S
- Dimension: 3.5 ft (tall), 3 ft (long)
- Max range: 37 miles depending on usage
- Max speed: 4.8 MPH
- Wheel: 8" solid
- Weight: 29 pounds
- Frame material: Magnesium alloy
- Motor: 250w
- Battery: lithium battery, direct charging (LimeBike Operations team will collect all scooters and recharge in our warehouse every 2 days)
- Battery charging time: 4.5~5 hrs

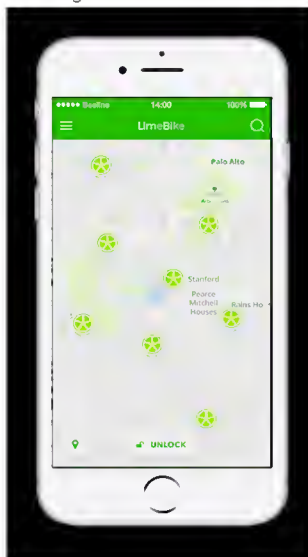


How to Ride Lime

Lime is the fastest, easiest way to get around. Riding a mobility device from start to finish takes only four easy steps. First, the rider downloads the Lime app and sets up an account in order to locate available pedal bikes, e bikes, and scooters through the app. The rider then scans the QR code or enters the bike/scooter number to unlock. The bike or scooters plays a cheerful musical tune to indicate it unlocked and ready to ride. When the rider reaches a destination, the rider parks at an appropriate area. Pedal bikes and e bikes have a rear wheel lock, and the rider locks the bike using the red push button on the lock. Scooters are locked through the app. When locked, the app will confirm the bike or scooter is locked and provide a trip summary. Four easy steps: Riders find available bikes or scooters, unlock with the QR code, lock to end the ride, and easily track and pay for the ride (see diagram below).

Step 1

Locate available
bicycle or scooter:



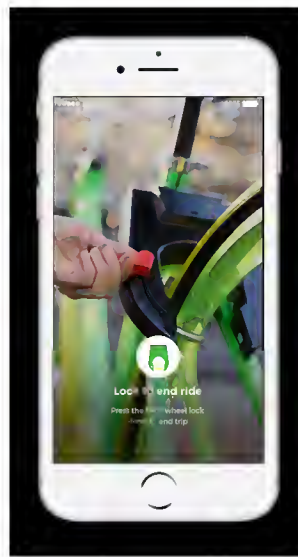
Step 2

Unlock via QR
code or text:



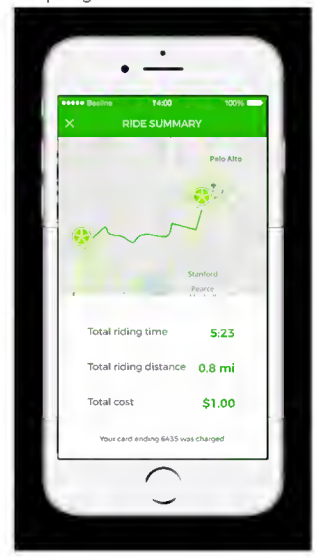
Step 3

Lock to end
the ride:



Step 4

Easily track and
pay for the ride:



Austin Roll Out and Operations

Lime can immediately deploy mobility devices to Austin. In accordance with the permit, LimeBike will deploy no more than 500 mobility devices per permit issued in Austin.

In similar urban environments, we typically deploy bikes and scooters near municipal buildings, dense residential areas, bike trails, transit stops, commercial corridors, libraries, currently underserved areas, and other requested destinations. In Austin, our initial deployment will take place in the Downtown Austin Project Coordination Zone (DAPCZ).

As we launch Lime in Austin, we will begin the deployment by rolling out bikes, e assist bikes, and scooters at a number of predetermined locations around the DAPCZ.

Day-to-Day Operations

Various factors contribute to the success in our markets. However, a critical factor to our success is our robust, on the ground, operations team. We provide the following services completely free:

- The Daily Patrol Team: This team begins with 2-4 people who will conduct a full sweep of the service area each day. They will re-park any misplaced bikes, fix any bikes that need repair (we're open to working with any local partners if you've already partnered with them for repairs or other bikes services), or bring broken bikes back to the warehouse for repair. The team will also wipe down bikes as they go, and wash bikes that were brought back for maintenance at the warehouse.
- The Quick Response Team: This team begins with 2-4 people and will be available for 24 hours each day on weekdays and weekends. Their job is to respond to all customer complaints within 2 hours and help manage, remove and repark bikes and scooters in question.
- The Distribution Team: The Distribution team will remove all bikes idle for more than one week in our bike tracking tool, then redeploy them to higher demand areas to maximize utilization.
- Local Brand Ambassadors: In addition to leveraging the Lime Marketing Team, we'll hire part-time Brand Ambassadors (likely students and advocates in Austin) to help educate, promote, and integrate into the local community.
- Customer Service Team: All of our customer service calls are routed to one center in San Mateo, California. When a rider calls 888 LIME 345, we can assure 95 percent of calls are answered within 30 seconds and 95 percent of emails are answered within 24 hours. Riders can also contact customer service within the app. When damaged bikes or scooters are reported to our customer service team, a customer service agent puts the bike in maintenance mode to prevent another user from riding it. From there, the issue is dispatched to our local operations team who then

inspects it within 2 business hours and either fixes it on site or if it is a critical issue, brings the bike back to the local warehouse.

We also work with host communities to integrate LimeBike into Austin's existing transit systems. This includes partnering with Cap Metro to place bikes and scooters at transit stops, including Lime locations and rental options into transit smartphone apps, and (if possible) creating a seamless payment option for multimodal trips. In cities where we have undertaken these efforts, the results have been very successful, driving trips to local public transit options and relieving vehicle congestion. Across the nation, we see nearly a fifth of all Lime rides begin or end near a transit station. In some cities, more than 40% of our rides connect to public transit.

LimeBike Team in Austin

The Lime team in Austin will be staffed by locals, drawing on the vast experience and expertise present in the Austin region.

The LimeBike team in Austin will be as follows:

- **Operations Manager** The leader of the Austin team, Zachary Carter will be responsible for managing our presence in the Austin region. Zachary will be the city's primary point of contact for all operational issues. Zachary can be reached at [REDACTED] or (972) 672 09 7. Zachary will also partner with local community organization on our education, press, and outreach efforts.
- **Operations Specialists** The backbone of our team, the operations specialists are responsible for daily operations, including driving around town ensuring bikes are properly positioned and distributed across the DAPCZ, repair and maintain our fleet of mobility devices and help at local transportation and other target outreach events.
- **Government Relations** Sam Sadle, Lime's Texas Director of Strategic Development, will continue to serve as the city's primary contact when it comes to the overall relationship between Lime and the City of Austin. Sam can be reached at [REDACTED] or (202) 64 6 62.

Marketing and Outreach Plan

We have already begun to work to introduce the Austin community to the concept of dock free mobility and moving forward will accelerate our outreach to riders around parking protocols and identifying areas that are off limits to parking. This education effort will take place in partnership with local organizations and other dock free mobility service providers.

Our education efforts will be overseen by Zachary Carter, our Austin Operations Manager. Mr. Carter will continue our ongoing partnerships with community groups from across the city, creating awareness for Lime and dock free mobility in general. As our team grows, so will this effort, with particular emphasis on reaching out to low income residents, communities of color, and non english speakers (note: our website, our app, and our customer service call center are available in both English and Spanish).

These efforts will be supplemented by online education efforts, including an Austin specific Lime FAQ to be posted on both the city's webpage and printed out to hand out at community meetings. We will also undertake a press strategy in partnership with the city which will focus on announcing the program's forthcoming launch and teaching people how to use (and park) Lime. This will include a press advisory, and direct outreach to newspapers, websites, and others interested in the program. Our press kit can be found [here](#).

We will continue our outreach to large employers, Cap Metro, and area universities, ensuring that they have all the necessary information to about Lime and what services we provide, so no one is caught off guard by the sudden appearance of green bikes and scooters throughout their community.

Launch Process

The launch will also have a significant media and social media component, including a ceremonial unlocking, media availabilities with our team on the ground, and online promotion to include Facebook posts, facebook live, Twitter and Instagram, both on Lime channels and through City of Austin channels. We already have a significant bank of introductory material that can be shared with the community throughout the launch process including the Lime [YouTube channel](#) and an introduction to Lime [how to video](#).

Continuing Education Efforts

Once we launch, our education and outreach efforts only increase. We are already planning on partnering with local universities and community groups (such as Bike Austin) to host "how to bikeshare"

events. We will also continue our online efforts and will produce Austin specific shared mobility guidance and pushing that out through local media, community, and other pathways.

A particular emphasis of this effort will be built around proper parking technique. We have developed a number of education modules that we will roll out as part of our system in Austin, including in app education, online education, and via in person events. Lastly, of course, we always have our on the ground operations team that can respond to any challenges that come to the forefront as the system expands.

Safety Response Plan

Safety is at the core of everything we do as a company. This means taking every possible effort to ensure that our riders are as safe as possible and that we are operating in the safest possible manner.

First and foremost this means focusing on rider safety. As such, we partner with local organizations such as Bike Austin to support bicycle safety classes for riders. This includes both the provision of financial support as well as providing bicycles for events and classes. Another safety initiative is our Lime helmet program. Any rider who places at least \$ 0 on their account can have a helmet sent to them at no charge. All they need to do is reach out to our customer support team to place the request. Note: All riders under 18 years of age are required to use a helmet and are not allowed to use either our e assist bike or our electric scooter.

Key to keeping Lime riders safe is ensuring that all devices are in proper working order and undergoing ongoing maintenance. Please see our section on maintenance for more information.

While bicycles and scooters are some of the safest conveyances available, there remains the potential for an accident. When accidents occur, we partner with local law enforcement, paramedics, and other safety professionals to ensure our riders get the best possible care and to better understand the cause of the accident to ensure it does happen again. We look forward to partnering with the City of Austin on bicycle and scooter safety initiatives to help bring the Vision Zero initiative to fruition.

Maintenance, Cleaning, Repair and Waste Management Plan

Our fleet team will touch each bicycle or scooter a minimum of once per week. A 'touch' is a full safety evaluation, including inspection of the brakes, saddle, gears, bell, headset, pedals, motor, display and more. Any device deemed sub standard by a field tech will be removed from the grid (aka, made inaccessible to the public) and brought to a repair center. Please note that in systems we currently operate, it is typical that our devices are touched by staff several times per week.

In addition to our team, Lime riders play an essential role in maintenance process. If some happens when someone is riding a bike or scooter or a member of the public notices an issue with a bike or scooter we encourage them to report the challenge, either through our smartphone app or through calling or texting our 24 hour customer support team at (888)LIME 345 or emailing us at [REDACTED]. Once an issue is reported, a Lime team member is deployed to assess the issue and take appropriate action, fixing the issue in the field or bringing the mobility device back to the warehouse for repair. We can and regularly do disable bicycles remotely by placing them in maintenance mode. This removes them from our in app map and makes it so that anyone happening upon the bicycles cannot unlock and use the bike.

For any unforeseen crisis, first steps are always to identify the problem, determine the problem's scope, quarantine the affected devices and bring them in for repair, and then redeploy fixed devices as soon as possible. A crisis might be weather related damage to multiple devices. It could be a targeted and deliberate vandalism event that affects dozens of devices across a wide area. Or it could be as simple as a manufacturer's recall of a key component that requires a fleet wide retrofit.

Lime bikes and scooters are designed for years of use, abuse, and the hot Texas sun. This means that with appropriate maintenance and repairs, we expect our dock free mobility devices to operate for at least five years before needing to be fully taken out of service. However, before that time, we make every effort to ensure that we are properly managing our fleet, reusing parts from previously decommissioned devices and wasting as little as possible.

Once reused components need to be finally disposed of, we will recycle all metal, rubber, and plastic elements (which make up the vast majority of the devices) with a reputable local recycling company at Lime's expense. Likewise, the lithium batteries that power our e assist bikes, scooters, and GPS units will be disposed of through a third party recycling company at Lime's expense.

Data and Performance Tracking

The Lime team has experience in warehousing user data for top tech companies with a real time, robust, and secure data tracking system that acts as the ears and eyes of Lime's business. Always putting our riders first, we securely record and store riders' personal information in encrypted databases. We also have access control policies to make sure data is not shared with anyone outside the company, or within the company except for specific administrators for legitimate uses.

As part of our deployment, we will be rolling out a real time dashboards to help the city track the usage status of every bike in circulation and major rider actions in the app. This data is all processed anonymously to give us and you a clear picture of overall rider lifecycles, usage patterns, location of idle or broken bikes, and key performance metrics, without compromising personal privacy. We anticipate working closely with city staff to identify opportunities to improve both the system and local infrastructure.

As part of our partnership, Lime will submit a monthly report to City staff to assist with enhancements of the dock free mobility program. This report will include a summary of the number and status of bikes and scooters, total rides, and total riders currently on our platform. Below are some components of the customizable report:

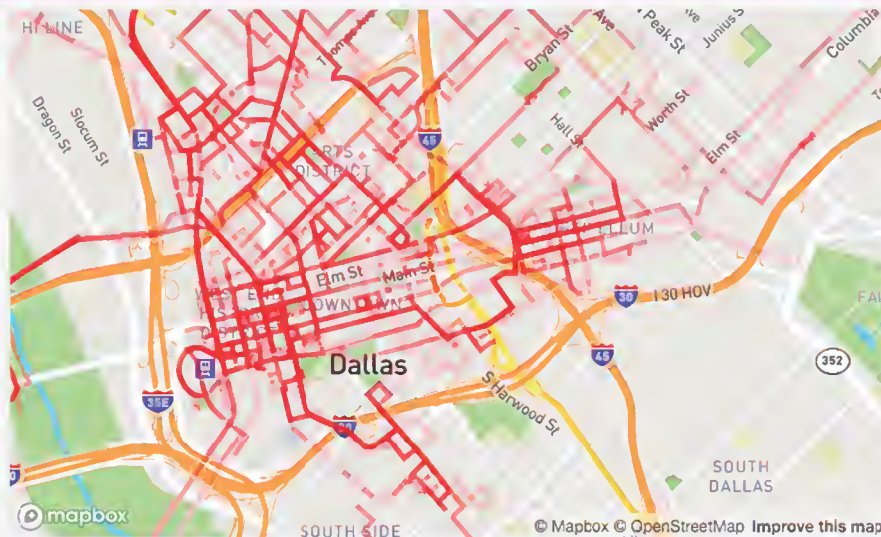
- Usage (daily/quarterly/annually)
- Total miles (daily/quarterly/annually)
- Number of bikes and scooters in circulation
- Daily, weekly and monthly active riders (including members/walk up renters)
- Number and duration of rides / rider / day
- Number and duration of rides / bike / day
- Monthly summary of distribution and GPS based natural movement
- Incidents report and resolution with comments/complaints, theft/vandalism, crashes
- Time saved by residents and commuters
- Greenhouse gas emissions reduced

We also will provide the City of Austin with route and ridership information in order to improve bike/pedestrian mobility and safety (see Appendix A for examples). We hope this data will serve to enhance ridership and fully integrate dock free mobility in the community.

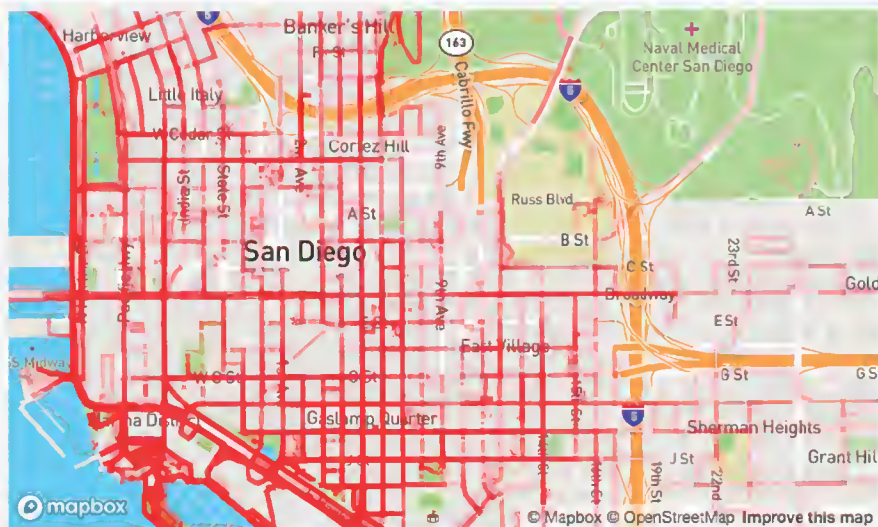
Appendix A: Visual Data

The below city examples are two examples of our heat maps. They enable community planners to spot visual patterns immediately. The more heavily Lime populated paths are indicated in darker shades with lighter shades indicating lightly populated routes.

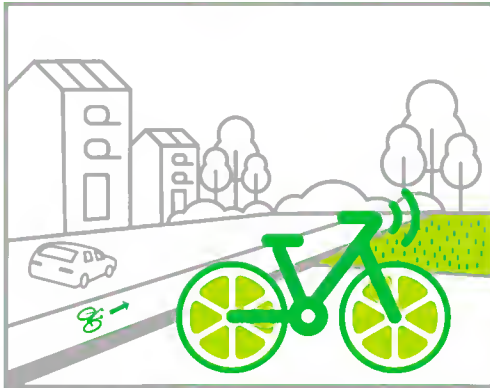
Dallas, Texas



San Diego, California



Appendix B: User Education Samples



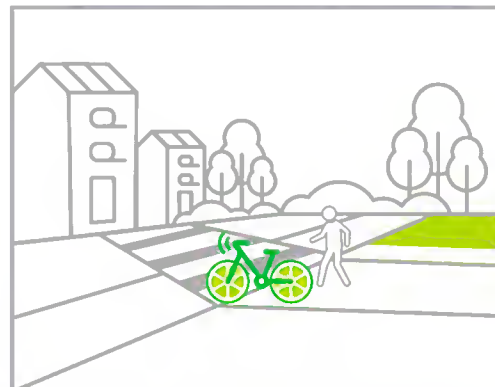
Do park by the sidewalk pavement, not on grass.



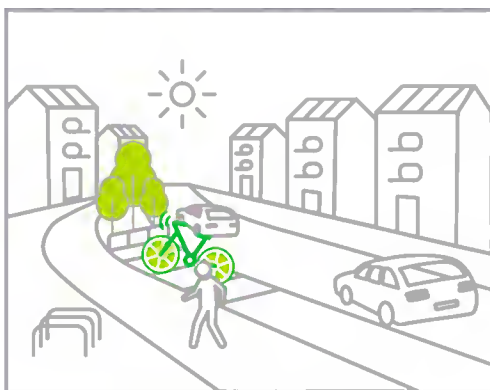
Do not place the bike on the ground.



Do park near a bikerack or designated area.



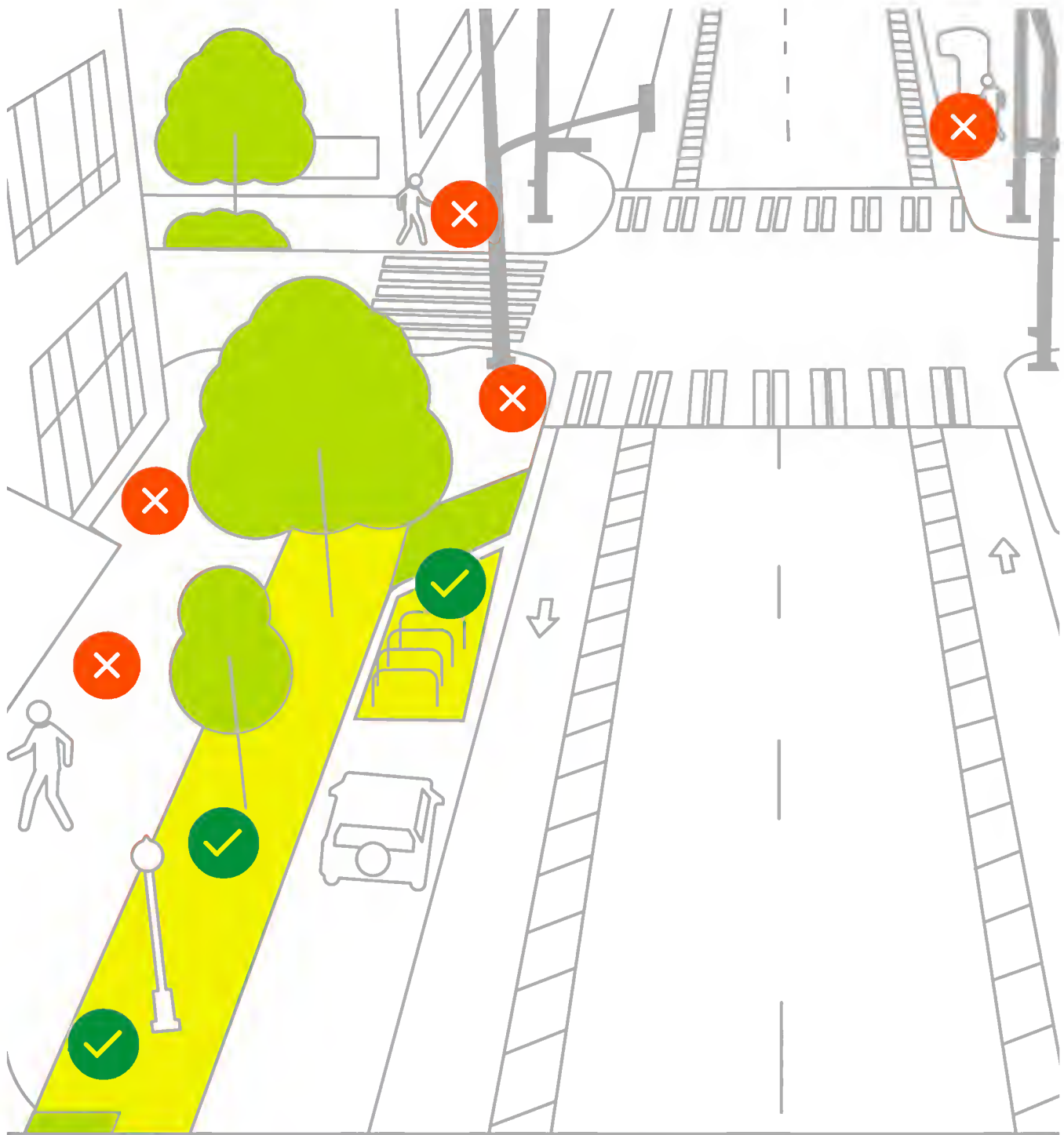
Do not block pedestrian or wheelchair path access, driveways, crosswalks, loading zones.



Do park in furniture zone.



Do not park at bus stops or street corners.



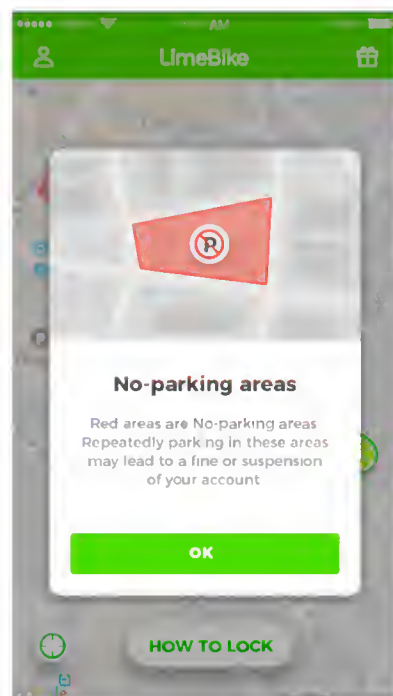
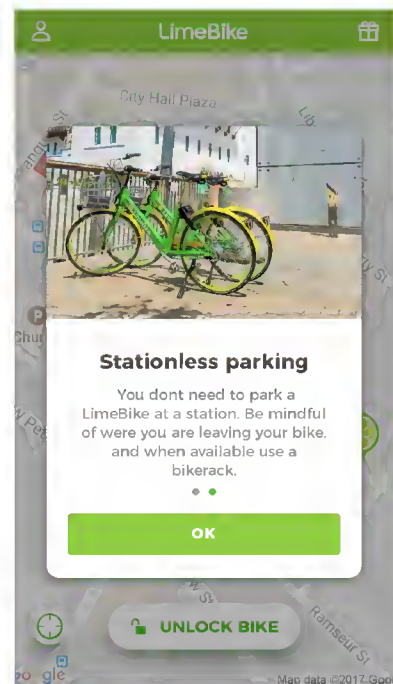
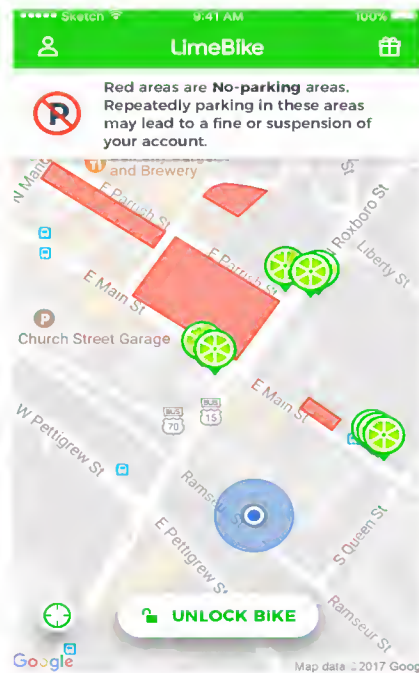
**Park your bike
share here**



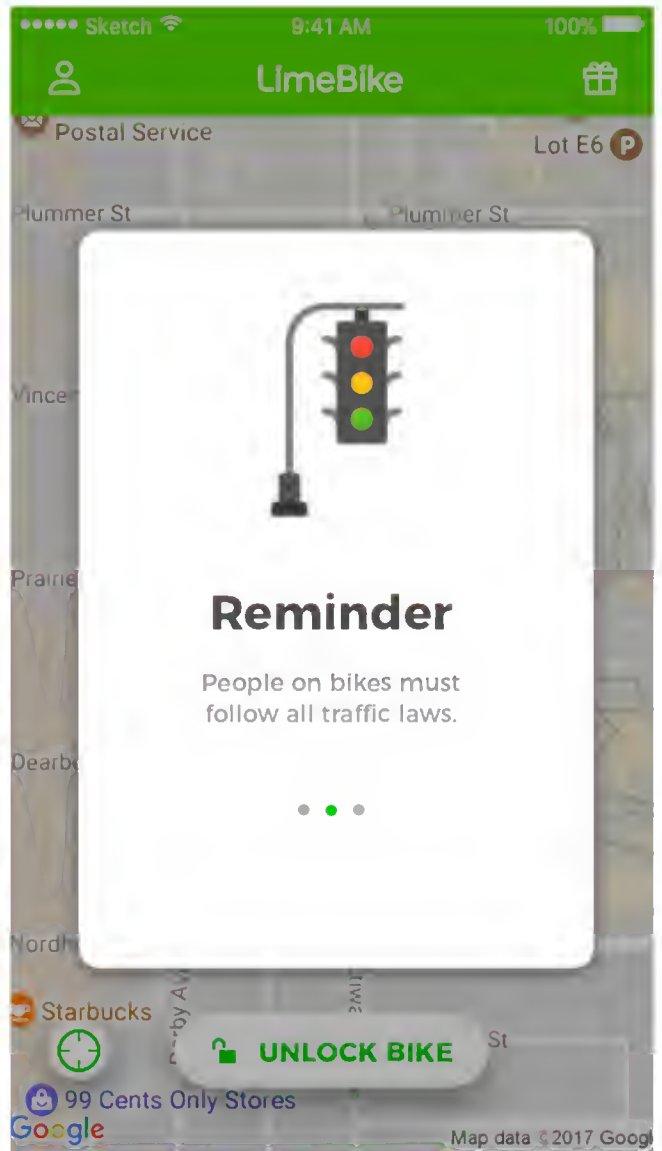
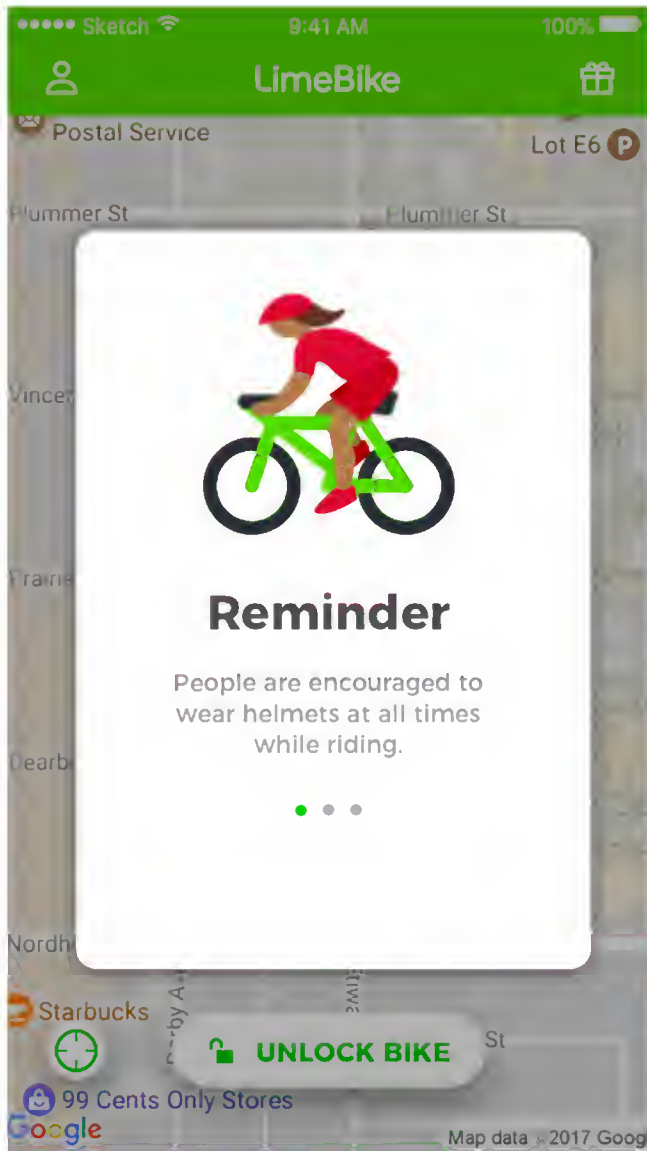
**Don't park your
bike share here**

Appendix C: In-App Screenshots

Parking-related screenshots



Helmet and Local Law Screenshots



Appendix D: User Agreement and Terms of Service

Last Updates to Our User Agreement & Terms of Service: May 8, 2018.

PLEASE READ EACH PROVISION OF THIS AGREEMENT CAREFULLY. IT SETS FORTH THE LEGALLY BINDING TERMS AND CONDITIONS FOR YOUR USE OF THE SERVICES (DEFINED BELOW). BY ACCESSING AND/OR USING OUR SERVICES, YOU AGREE TO BE LEGALLY BOUND BY THIS AGREEMENT. IF YOU DO NOT AGREE TO THIS AGREEMENT AND THE CONDITIONS OF USE STATED HEREIN, INCLUDING THE ARBITRATION AND CLASS ACTION WAIVER PROVISIONS, DO NOT USE THE SERVICES.

IMPORTANT NOTICE: THIS AGREEMENT IS SUBJECT TO BINDING ARBITRATION AND A WAIVER OF CLASS ACTION RIGHTS AS FURTHER DETAILED IN SECTION 2 BELOW. BY AGREEING TO ARBITRATE, EACH PARTY IS GIVING UP ITS RIGHT TO GO TO COURT AND HAVE ANY DISPUTE HEARD BY A JUDGE OR JURY. BY AGREEING TO WAIVE CLASS ACTION RIGHTS, EACH PARTY AGREES THAT EACH MAY BRING CLAIMS AGAINST THE OTHER ONLY IN YOUR OR OUR INDIVIDUAL CAPACITY, AND NOT AS A PLAINTIFF OR CLASS MEMBER IN ANY PURPORTED CLASS OR REPRESENTATIVE PROCEEDING OR AS AN ASSOCIATION.

This User Agreement & Terms of Service (collectively, the “Agreement”) is a legally binding agreement between you (“You,” “Your,” or “User”) and Neutron Holdings, Inc., doing business as LimeBike, and doing business as Lime (“Lime,” “We,” “Us,” or “Our”). This Agreement states the material terms and conditions that governs Your use of Our Services.

Our Services are comprised of the following:

1. Our Bike Share bicycle parking locations (“Locations”);
2. Our Bike Share bicycles (“Bike”), electric bicycles (“Lime E”), and electric scooters (“Lime S”). Lime E and Lime S are collectively referred to as “E vehicles.” Bikes and E vehicles are collectively referred to as “Products;”
3. All other related equipment, maintenance, charging of the E vehicles, personnel, mobile applications, other software and information provided or made available by Us; and
4. Use of Our website, available at www.limebike.com (including any versions optimized for viewing on a wireless or tablet Device), Our mobile application (the “App”) and any interactive features, and/or other services that We make available and that post a link to this Agreement.

This Agreement, together with all updates, supplements, additional terms, and all of Our rules and policies collectively constitute this “Agreement” between You and Us.

We expressly agree to let, and You expressly agrees to take on, rental of the Products, subject to the terms and conditions set forth herein. Unless otherwise indicated, all monetary values set forth in this Agreement shall be deemed to be denominated in U.S. dollars.

In some instances, both this Agreement and separate guidelines, rules, or terms of use, setting forth additional or different terms and/or conditions will apply to Your use of the Services (in each such instance, and collectively, “Additional Terms”). The Additional Terms are incorporated into this Agreement by this reference. To the extent there is a conflict between this Agreement and any Additional Terms, this Agreement will control unless the Additional Terms expressly state otherwise. By using the Services, You acknowledge and accept the Lime Privacy Policy, and consent to the collection and use of Your data in accordance with that Privacy Policy.

RENTAL AND USE OF PRODUCTS.

. . You are the Sole User of the Services: Subject to Section .3 below regarding the limited use of Bikes by minors, You certify and expressly agree that You are the sole renter and You are responsible for compliance with all terms and conditions contained in this Agreement. You understand that when You activate a Product, the Product must be used ONLY BY YOU. You must not allow others to use a Product that You have activated.

.2. You are At Least 18 Years Old: You represent and certify that You are at least 18 years old, and that You have a valid driver’s license.

.3. Minor Use of Bikes: You may allow a minor who is at least 13 years of age to use a BIKE ONLY, subject to the following conditions:

.3. . You are the minor’s parent or legal guardian;

.3.2. You assume full financial and/or any other responsibility for any and all misuse, consequences, claims, demands, causes of action, losses, liabilities, damages, injuries, fees, costs and expenses, penalties, attorneys’ fees, judgments, suits and/or disbursements of any kind, or nature whatsoever, whether foreseeable or unforeseeable, and whether known or unknown, as a result of the minor’s use of the Bike and/or any of the Services;

.3.3. You expressly guarantee, represent, and warrant that You and the minor are bound by this Agreement and all of the terms herein;

.3.4. You expressly guarantee, represent, and warrant that You will supervise the minor at all times while the minor is using the Bike;

.3.5. You expressly guarantee, represent, and warrant that You have conducted the requisite safety check of the Bike prior to use, and that You will constantly monitor the Bike while the minor is riding to ensure safety;

.3.6. You expressly guarantee, represent, and warrant that the minor is wearing a Snell, CPSC, ANSI or ASTM approved helmet that has been properly sized, fitted and fastened according to the manufacturer's instructions at all times while riding the Bike; and

.3.7. You expressly guarantee, represent, and warrant that You have explained all applicable laws, rules, regulations, and/or ordinances to the minor, including any and all rules regarding parking and traffic laws.

OPERATION OR USE OF ANY E VEHICLES BY ANY MINOR IS EXPRESSLY PROHIBITED. IF YOU ALLOW A MINOR TO USE AN E VEHICLE BY ACTIVATING IT THROUGH YOUR ACCOUNT, YOU SHALL BE RESPONSIBLE FOR ANY AND ALL MISUSE, CONSEQUENCES, CLAIMS, DEMANDS, CAUSES OF ACTION, LOSSES, LIABILITIES, DAMAGES, INJURIES, FEES, COSTS AND EXPENSES, PENALTIES, ATTORNEYS' FEES, JUDGMENTS, SUITS AND/OR DISBURSEMENTS OF ANY KIND, OR NATURE WHATSOEVER, WHETHER FORESEEABLE OR UNFORESEEABLE, AND WHETHER KNOWN OR UNKNOWN.

.4. You are a Competent Operator: You represent and certify that You are familiar with the operation of the Product, and You are reasonably competent and physically fit to use the Product. By choosing to ride a Product, You assume all responsibilities and risks for any injuries and/or medical conditions, as detailed further below. You are responsible for determining whether conditions, including rain, snow, hail, ice or electrical storms, and/or any other conditions, whether caused by the weather or otherwise, make it dangerous to operate a Product. You are advised to adjust Your riding behavior and braking distance to suit all conditions and variables, including weather and traffic.

.5. Products are the Exclusive Property of Lime: You agree that the Products, and any Lime equipment attached thereto, at all times, remain the exclusive property of Lime. You must not dismantle, write on, or otherwise modify, repair or deface any Products, or any part of any of the Products, or any other Lime equipment in any way. You must not write on, peel, or otherwise modify or deface any sticker on a Products in any way. You must not use any Products for any advertising or commercial purpose.

.6. Only Use Products Where Allowed: You expressly agree that You will only use the Products in areas where the Products are allowed. You agree that You will not use any Products in any restricted areas (such as cities that prohibit certain Products), and You assume all responsibility and liability for any

operation of any Product in any restricted area, including any fines or fees as a result of Your use of any of the Products in any restricted areas.

.7. Compliance with Laws: You agree to follow all laws, rules, regulations, and/or ordinances pertaining to the use, riding and/or operation of the Products, including those pertaining to the Products in the area where You are operating the Products, including, without limitation, helmet laws.

YOU ARE SOLELY RESPONSIBLE AND LIABLE FOR ANY VIOLATION OF ANY LAWS, RULES, REGULATIONS, AND/OR ORDINANCES WHILE USING THE SERVICES, INCLUDING IMPROPER RIDING AND/OR PARKING, AND YOU AGREE THAT YOU ARE SOLELY RESPONSIBLE AND LIABLE FOR ANY AND ALL CONSEQUENCES, CLAIMS, DEMANDS, CAUSES OF ACTION, LOSSES, LIABILITIES, DAMAGES, INJURIES, COSTS AND EXPENSES, PENALTIES, ATTORNEYS' FEES, JUDGMENTS, SUITS, FEES (INCLUDING IMPOUNDING FEES CHARGED BY ANY LOCAL GOVERNMENT) AND/OR DISBURSEMENTS OF ANY KIND, OR NATURE WHATSOEVER, WHETHER FORESEEABLE OR UNFORESEEABLE, AND WHETHER KNOWN OR UNKNOWN, AS A RESULT OF USING ANY OF THE SERVICES.

.8. Payment of Fines and Fees: You agree to pay any fines, fees, penalties, impounding charges, and/or any other charges incurred by Lime, that result from You parking any Product improperly, or as a result of You violating any law, rule, regulation, and/or ordinance while using the Services.

.9. Prohibited Acts: YOU EXPRESSLY CERTIFY AND AGREE THAT YOU WILL NOT:

.9. . Operate any Product in violation of any laws, rules, regulations, and/or ordinances, including any and all rules pertaining to riding any Products on sidewalks and/or parking Products.

.9.2. Operate any Product while carrying any briefcase, backpack, bag, or other item if it impedes Your ability to operate safely the Product.

.9.3. Use any cellular telephone, text messaging Device, portable music player, and/or any other Device that may distract You from safely operating any Product.

.9.4. Operate any Product while under the influence of any alcohol, drugs, medication, and/or any other substance that may impair Your ability to safely operate any Product.

.9.5. Carry a second person on any of the Products.

.9.6. Use locking mechanisms other than those provided by Lime.

.9.7. Park any Product in a manner that does not strictly comply with all applicable laws, rules, regulations, and/or ordinances. You expressly agree that You are responsible for becoming familiar with

any and all applicable laws, rules, regulations, and/or ordinances in the location that You are operating any Product.

.9.8. Park any Product in a manner that prevents Lime from accessing it.

. 0. Products are Intended for Only Limited Types of Use: You agree that You will not use any Product for racing, mountain riding, stunt, or trick riding. You agree that You will not operate and/or use any Products on unpaved roads, through water (beyond normal urban riding), or in any location that is prohibited, illegal and/or a nuisance to others. You agree that You will not use any Products for hire or reward, nor use any Products in violation of any law, rule, regulation, and/or ordinance.

. . Weight and Cargo Limits: You must not exceed the maximum weight limit for any Products (300 pounds) or the cargo carrier/basket on any Products (5 pounds), and You must not otherwise use the cargo carrier improperly with regard to type of contents or any visual obstruction or riding impediment. You acknowledge that the front carrier/basket and/or back basket of any Product is intended for light goods only, and that You will not carry people or animals anywhere on any Product.

. 2. No Tampering: You must not tamper with, attempt to gain unauthorized access to, or otherwise use any Services in a manner that does not comply with this Agreement.

. 3. Reporting of Damage or Crashes: You must report any accident, crash, damage, personal injury, stolen or lost Product to Lime as soon as possible. If a crash involves personal injury, property damage, or a stolen Product, You shall file a report with the local police department within 24 hours.

. 4. Assumption of Liability by You: YOU AGREE THAT YOU ARE SOLELY RESPONSIBLE AND LIABLE FOR ANY MISUSE, CONSEQUENCES, CLAIMS, DEMANDS, CAUSES OF ACTION, LOSSES, LIABILITIES, DAMAGES, INJURIES, FEES, COSTS AND EXPENSES, PENALTIES, ATTORNEYS' FEES, JUDGMENTS, SUITS AND/OR DISBURSEMENTS OF ANY KIND, OR NATURE WHATSOEVER, WHETHER FORESEEABLE OR UNFORESEEABLE, AND WHETHER KNOWN OR UNKNOWN, AS A RESULT OF USING ANY OF THE SERVICES.

. 5. You are Responsible for Product Damage: You agree to return any Product to Lime in the same condition in which such Product was rented. You will not be responsible for normal wear and tear of the Products.

. 6. Availability and Usage of E vehicles: You agree and acknowledge that E vehicles may not be available at all times. E vehicles require periodic charging of batteries in order to operate. You agree to use and operate E vehicles safely and prudently and comply with all restrictions and requirements associated with E vehicles, as set forth in any all applicable laws, rules, regulations, and/or ordinances. You understand and agree to the following:

. 6. . The level of charge power remaining in the E vehicle will decrease with use of the E vehicle (over both time and distance), and that as the level of charge power decreases, the speed and other operational capabilities of the E vehicle may decrease (or cease in their entirety).

. 6.2. The level of charging power in the E vehicle at the time You initiate the rental or operation of E vehicle is not guaranteed and will vary with each rental use.

. 6.3. The rate of loss of charging power during the use of the E vehicle is not guaranteed and will vary based on the E vehicle, road conditions, weather conditions and/or other factors.

. 6.4. It is Your responsibility to check the level of charge power in the E vehicle and to ensure that it is adequate for the ride before initiating operation of the E vehicle.

. 6.5. Lime does not guarantee the distance and/or time that You may operate any E vehicle before it loses charging power completely. The E vehicle may run out of charging power and cease to operate at any time during Your rental of the E vehicle, including before reaching Your desired destination.

2. ARBITRATION; CLASS ACTION WAIVER; DISPUTE RESOLUTION.

2. . Dispute Resolution: Certain portions of this Section 2 are deemed to be a “written agreement to arbitrate” pursuant to the Federal Arbitration Act. You and Lime expressly agree and intend that this Section 2 satisfies the “writing” requirement of the Federal Arbitration Act. This Section 2 can only be amended by mutual agreement.

2.2. Informal Resolution of Disputes and Excluded Disputes: If any controversy, allegation, or claim arises out of or relates to the Services, the Content, Your User Submissions, this Agreement, or any Additional Terms, whether heretofore or hereafter arising (collectively, “Dispute”), or to any of Lime’s actual or alleged intellectual property rights (an “Excluded Dispute”), then You and Lime agree to send a written notice to the other providing a reasonable description of the Dispute or Excluded Dispute, along with a proposed resolution of it. Our notice to You will be sent to You based on the most recent contact information that You provide us. But if no such information exists or if such information is not current, then We have no obligation under this Section 2. . Your notice to us must be sent to: Lime, 2 2 S. El Camino Real, Suite B 00, San Mateo, California 94403 (Attn: Legal Department). For a period of sixty (60) days from the date of receipt of notice from the other party, Lime and You will engage in a dialogue in order to attempt to resolve the Dispute or Excluded Dispute, though nothing will require either You or Lime to resolve the Dispute or Excluded Dispute on terms with respect to which You and Lime, in each of our sole discretion, are not comfortable.

2.3. Binding Arbitration: If We cannot resolve a Dispute as set forth in Section 2 (or agree to arbitration in writing with respect to an Excluded Dispute) within sixty (60) days of receipt of the notice, then ANY AND ALL DISPUTES ARISING BETWEEN YOU AND LIME (WHETHER BASED IN CONTRACT, LAW, STATUTE, RULE, REGULATION, ORDINANCE, TORT INCLUDING, BUT NOT LIMITED TO, FRAUD, ANY OTHER INTENTIONAL TORT OR NEGLIGENCE, COMMON LAW, CONSTITUTIONAL PROVISION, RESPONDEAT SUPERIOR, AGENCY AND/OR ANY OTHER LEGAL OR EQUITABLE THEORY), WHETHER ARISING BEFORE OR AFTER THE EFFECTIVE DATE OF THIS AGREEMENT, MUST BE RESOLVED BY FINAL AND BINDING ARBITRATION. THIS INCLUDES ANY AND ALL DISPUTES BASED ON ANY PRODUCT, SERVICE OR ADVERTISING CONNECTED TO THE PROVISION OR USE OF THE SERVICES. The Federal Arbitration Act (“FAA”), not state law, shall govern the arbitrability of all disputes between Lime and You regarding this Agreement (and any Additional Terms) and the Services, including the “No Class Action Matters” Section below. BY AGREEING TO ARBITRATE, EACH PARTY IS GIVING UP ITS RIGHT TO GO TO COURT AND HAVE ANY DISPUTE HEARD BY A JUDGE OR JURY. Lime and You agree, however, that State or federal law shall apply to, and govern, as appropriate, any and all claims or causes of action, remedies, and damages arising between You and Lime regarding this Agreement and the Services, whether arising or stated in contract, statute, common law, or any other legal theory, without regard to State’s choice of law principles.

2.4. Applicability of JAMS Rules and Location of Arbitration: A Dispute will be resolved solely by binding arbitration in accordance with the then current Commercial Arbitration Rules of the Judicial Arbitration and Mediation Services Inc. (“JAMS”) using JAMS’ streamlined Arbitration Rules and Procedures, or by any other arbitration administration service that You and an officer or legal representative of Lime consent to in writing. If an in person arbitration hearing is required, then it will be conducted in the “metropolitan statistical area” (as defined by the U.S. Census Bureau) where You are a resident at the time the Dispute is submitted to arbitration. You and Lime will pay the administrative and arbitrator’s fees and other costs in accordance with the applicable arbitration rules; but if applicable arbitration rules or laws require Lime to pay a greater portion or all of such fees and costs in order for this Section 2 to be enforceable, then Lime will have the right to elect to pay the fees and costs and proceed to arbitration. The arbitrator or arbitration panel, as the case may be, will apply and be bound by this Agreement and any Additional Terms, and will determine any Dispute according to applicable law and facts based upon the record and no other basis, and will issue a reasoned award. All issues are for the arbitrator to decide, including arbitrability. This arbitration provision shall survive termination of this Agreement or the Services. You can obtain JAMS procedures, rules, and fee information as follows: JAMS: 800.352.5267 and <http://www.jamsadr.com>.

2.5. Arbitrator’s Decision: The Arbitrator will render a written decision within the time frame specified in the JAMS Rules. Judgment on the arbitration award may be entered in any court having competent jurisdiction to do so. The Arbitrator may award declaratory or injunctive relief only in favor of the claimant and only to the extent necessary to provide relief warranted by the claimant's individual claim. The Arbitrator’s decision shall be final and binding on all parties. The prevailing party in the arbitration

shall be entitled to an award of attorneys' fees and costs, as long as the Arbitrator includes such an award of attorneys' fees and costs in the written decision.

2.6. Limited Time to File Claims: TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, IF YOU OR LIME WANT TO ASSERT A DISPUTE (BUT NOT AN EXCLUDED DISPUTE) AGAINST THE OTHER, THEN YOU OR LIME MUST COMMENCE IT (BY DELIVERY OF WRITTEN NOTICE AS SET FORTH HEREIN) WITHIN ONE () YEAR AFTER THE DISPUTE ARISES OR IT WILL BE FOREVER BARRED. Commencing means, as applicable: (a) by delivery of written notice as set forth herein; (b) filing for arbitration with JAMS as set forth herein; or (c) filing an action in state or Federal court.

2.7. Injunctive Relief: The foregoing provisions of this Section 2 will not apply to any legal action taken by Lime to seek an injunction or other equitable relief in connection with, any loss, cost, or damage (or any potential loss, cost, or damage) relating to the Services, any Content, Your User Submissions and/or Lime's intellectual property rights (including those that Lime may claim are in dispute), Lime's operations, and/or Lime's Products and/or Services.

2.8. No Class Action Matters: YOU AND LIME AGREE THAT EACH MAY BRING CLAIMS AGAINST THE OTHER ONLY IN YOUR OR ITS INDIVIDUAL CAPACITY, AND NOT AS A PLAINTIFF OR CLASS MEMBER IN ANY PURPORTED CLASS OR REPRESENTATIVE PROCEEDING OR AS AN ASSOCIATION. Disputes will be arbitrated only on an individual basis and will not be joined or consolidated with any other arbitrations or other proceedings that involve any claim or controversy of any other party. There shall be no right or authority for any Dispute to be arbitrated on a class action basis or on any basis involving Disputes brought in a purported representative capacity on behalf of the general public, or other persons or entities similarly situated. But if, for any reason, any court with competent jurisdiction holds that this restriction is unconscionable or unenforceable, then our agreement in Section 2 to arbitrate will not apply and the Dispute must be brought exclusively in court. Notwithstanding any other provision of this Section 2, any and all issues relating to the scope, interpretation and enforceability of the class action waiver provisions contained herein (described in this "No Class Action Matters" section), are to be decided only by a court of competent jurisdiction, and not by the arbitrator. The arbitrator does not have the power to vary these class action waiver provisions.

2.9. Federal and State Courts in San Mateo County, California: Except where arbitration is required above or with respect to the enforcement of any arbitration decision or award, any action or proceeding relating to any Dispute or Excluded Dispute arising out of or related to this Agreement, any Product, and/or any of the Services, may only be instituted in state or Federal court in San Mateo County, California. Accordingly, You and Lime consent to the exclusive personal jurisdiction and venue of such courts for such matters.

2. 0. Small Claims Matters Are Excluded from Arbitration Requirement: Notwithstanding the foregoing, either You or Lime may bring a qualifying claim or Dispute (but not Excluded Disputes) in small claims courts of competent jurisdiction.

3. PAYMENT AND FEES.

3.1. Fees: You may use the Products on a pay per ride basis or as otherwise in accordance with the pricing described in the App. In each case, fees and other charges may be subject to applicable taxes and other local and/or state government charges, which may be charged and collected by Lime. Lime will charge Your credit card or debit card (collectively, Your “Card”) or other agreed payment methods the amount of the fees as described in this Agreement.

3.2. Promo Codes: Promo codes (“Discounts”) are one time offers and can only be redeemed via the App. Lime reserves the right to modify or cancel Discounts at any time. Discounts are limited to one per customer and account and may not be combined with other offers. Discounts are non transferable and may not be resold.

3.3. Maximum Rental Time and Charges: Maximum rental time is 24 hours. You agree that You will deactivate the Product rental within 24 hours of time that rental of the Product began. You may then rent again. You agree that You are solely responsible for being aware of any elapsed time related to timely locking any Product. The maximum charge is \$50 for any Bike, and \$200 for any E vehicle, all based on a 24 hour period. After return of the Product, You will be charged the accumulated rental charges, or the maximum 24 hour charge; whichever is less. Products not returned (locked and a ride concluded) within 48 hours will be considered lost or stolen, and You may be charged up to \$600 for each Bike, \$2,000 for each Lime E, and \$,500 for each Lime S, and a police report may be filed against You. We may also charge a service fee of \$25, in Our sole discretion, for rentals in excess of 24 hours where the Product is not considered lost or stolen.

3.4. Valid Credit Card or Debit Card: You must input a valid Card number and expiration date before You will be registered to use the Services. You represent and warrant to Lime that You are authorized to use any Cards You furnish to Lime. You authorize Lime to charge the Card for all fees incurred by You. All fees are subject to applicable sales taxes and other local government charges, which may be charged and collected by Lime. If You dispute any charge on Your Card account, then You must contact Lime within 0 business days from the end of the month with the disputed charge, provide to Lime all trip information that is necessary to identify the disputed charge, such as the date of the trip and the approximate starting and ending times. You agree to immediately inform Lime of all changes relating to Your Card.

3.5. Pick Up Fees: If You are unable to return any Product to a valid area (i.e., You deactivate a Product on private property, a locked community, and/or any other unreachable area), and request that the Product be picked up by Lime, then We, in Our sole discretion, may charge You a pick up fee up to \$ 20. If any Product accessed under Your account is abandoned without notice, You will be responsible for all fees until the Product is recovered and deactivated, plus a service charge of up to \$ 20.00, to recover the Product. Fees are subject to change in Lime’s sole discretion, and without notice to You.



4. TERMS APPLICABLE TO SUBSCRIPTIONS.

4.1. Generally: To purchase access and use of any subscriptions offered through the Services, You must be at least eighteen (8) years of age or the applicable age of majority in Your jurisdiction of residence. Prior to the purchase and/or rental of any Products or Services, You must provide us with a valid Card number and associated payment information including all of the following: (i) Your name as it appears on the Card, (ii) Your Card number, (iii) the Card type, (iv) the date of expiration, and (v) any activation numbers or codes needed to charge Your Card or otherwise use a valid gift card. By submitting that information to us or our third party credit card processor, You agree that You authorize us and/or our processor to charge Your Card at our convenience but within thirty (30) days of Card authorization. For any product or service that You order on the Services, You agree to pay the price applicable (including any sales taxes and surcharges) as of the time You submit the order. Lime will automatically bill Your Card or other form of payment submitted as part of the order process for such price. We may offer a number of membership plans, including special promotional plans or memberships with differing conditions and limitations. Any materially different terms from those described in this Agreement will be disclosed at Your sign up or in other communications made available to You. Some promotional memberships are offered by third parties in conjunction with the provision of their own products and services. We are not responsible for the products and services provided by such third parties. We reserve the right to modify, terminate or otherwise amend Our offered membership plans.

4.2. Subscription Term & Termination: Except in the event of a free trial offer, Your subscription will commence as of the date Your payment for a subscription is received by Lime. Your subscription will continue in full force for the length of the term You specifically purchased or on a month to month term until such time as You cancel the subscription as further explained below (the "Subscription Term"). In the event that You cancel a subscription in the middle of Your Subscription Term, You will not be entitled to receive a refund for the unused portion of the remainder of that Subscription Term. Lime will have the right, upon written notice to You, to terminate this Agreement, and suspend Your access to their subscription, if: (a) You fail to pay Lime any amount due under this Agreement; and/or (b) You materially breach any term or condition of this Agreement. Lime shall have the right to terminate this Agreement and suspend Your access to the subscription with or without cause, upon thirty (30) days written notice to You in which case You will no longer be charged for access to the subscription. Upon the expiration or termination of this Agreement for any reason, Your access to, and use of, their subscription will terminate.

4.3. Free Trials/Promotional Offerings: We may offer promotional trial subscriptions to access the Services for free for a limited time or at special discounted prices. If You sign up for a trial use, Your rights to use the Services are limited by the terms of such trial and will terminate or renew on the terms of Your trial arrangement and/or any applicable Additional Terms. Please be aware that when You sign up for a free trial, You will be required to provide Your Card number and Lime will confirm Your Card is valid.



When We process Your Card, some credit card companies may place a temporary hold on Your account for Your first payment. Please contact Your Card company if You have questions. Please note that We do not provide price protection or refunds in the event of a price drop or promotional offering.

ONCE YOUR FREE TRIAL ENDS, WE OR A THIRD PARTY PAYMENT PROCESSOR WILL BEGIN BILLING YOUR DESIGNATED PAYMENT METHOD ON A RECURRING BASIS FOR YOUR SUBSCRIPTION (PLUS ANY APPLICABLE TAXES AND OTHER CHARGES) FOR AS LONG AS YOUR SUBSCRIPTION CONTINUES, UNLESS YOU CANCEL YOUR SUBSCRIPTION PRIOR TO THE END OF YOUR FREE TRIAL. INSTRUCTIONS FOR CANCELING YOUR MEMBERSHIP SUBSCRIPTION ARE DESCRIBED BELOW. PLEASE NOTE THAT YOU WILL NOT RECEIVE A NOTICE FROM US THAT YOUR FREE TRIAL HAS ENDED OR THAT THE PAID PORTION OF YOUR SUBSCRIPTION HAS BEGUN. WE RESERVE THE RIGHT TO MODIFY OR TERMINATE FREE TRIALS AT ANY TIME, WITHOUT NOTICE AND IN OUR SOLE DISCRETION.

4.4. Auto Renewal of Subscription Membership: Your subscription to the Services will automatically renew at the end of Your Subscription Term continuously and indefinitely without action by You, and the membership fee is charged to You at the time of renewal. Once Your membership fee has been paid You will be entitled to all privileges included in the membership until the membership is cancelled by You as set forth in the paragraph below. By providing Your payment method information for Your subscription, You are agreeing to pay a subscription fee, that will automatically renew, at the then current rate, unless You cancel prior to the expiration of the current Subscription Term, and any applicable taxes and service fees (collectively, “Fees”). The Fees will be charged to Your original payment method automatically at the beginning of Your Subscription Term, and at the beginning of each renewal Subscription Term thereafter on the calendar day corresponding to the commencement of Your current Subscription Term, unless You cancel Your subscription, or Your account is suspended or terminated pursuant to this Agreement. The renewal Subscription Term will be the same length as Your initial Subscription Term unless otherwise disclosed to You at the time of sale. The rate for the renewal Subscription Term will be the then current subscription rate. The Fees charged to Your payment method may vary from Subscription Term to Subscription Term due to changes in Your subscription plan or applicable taxes, and You authorize Lime to charge Your payment method for these amounts. Lime reserves the right to change the pricing of subscription at any time. In the event of a price change, Lime will post the new pricing on the Services and attempt to notify You in advance by sending an email to the address You have registered for Your account. You agree that We may change the pricing We charge You for Your subscription and any Products/Services offered in Your subscription package by providing You with notice through an electronic communication from us and You agree that all agreements, notices, disclosures, and/or any other communications that We provide to You electronically satisfy any legal requirement that such communications be in writing. You consent to our ability to change our pricing and the details of our subscription packages through an electronic communication to You. If You do not wish to accept a price or subscription package change made by us, You may cancel Your subscription as described below, otherwise You will be deemed to have consented to the price/subscription package change and authorize Lime to charge the new Fees to Your payment method. If there are any discrepancies in billing,

You hereby waive Your right to dispute such discrepancies if You do not notify Lime within sixty (60) days after they first appear on an account statement.

4.5. Cancellation of Subscription Membership: You have the right to cancel Your subscription membership at any time upon notice to Lime. To cancel Your subscription membership: open Your wallet in the Lime App, and click "Manage," then click "Cancel Membership." There are no refunds or credits for partial months. Cancellation of initial membership any time after purchase will result in forfeiture of the membership fee. To avoid a late cancellation fee or forfeiture of the membership renewal fee, membership should be cancelled prior to the end of the then current Subscription Term. Upon cancellation, You will lose access to the areas of the Services designated for subscription members only. This could include any credit and other data and analyses that have been displayed during Your subscription membership.

4.6. Methods of Payment, Credit Card Terms and Taxes: All payments to Lime are made through a third party payment processor(s). We accept any and all methods of payment that Our third party payment processor(s) accept. We currently do not accept cash, personal or business checks or any other payment form, although in the future We may change this policy. Your Card issuer agreement governs Your use of Your designated Card, and You must refer to that agreement and not this Agreement to determine Your rights and liabilities as a cardholder. You represent and warrant that You will not use any Card or other form of payment unless You have all necessary legal authorization to do so. YOU, AND NOT LIME, ARE RESPONSIBLE FOR PAYING ANY UNAUTHORIZED AMOUNTS BILLED TO YOUR CREDIT CARD BY A THIRD PARTY. You agree to pay all fees and charges incurred in connection with Your purchases (including any applicable taxes) at the rates in effect when the charges were incurred. Unless You notify Lime of any discrepancies within sixty (60) days after they first appear on Your Card statement, You agree that they will be deemed accepted by You for all purposes. If Lime does not receive payment from Your Card issuer or its agent, You agree to pay all amounts due upon demand by Lime or its agents. Sales taxes, or other taxes, customs, import/export charges, or similar governmental charges are not included in the price of the products. You are responsible for paying any such taxes or charges imposed on Your purchases, including, but not limited to, sales, use or value added taxes. Lime shall automatically charge and withhold the applicable tax for orders to be delivered to addresses within and any states or localities that it deems is required in accordance with our order policy in effect at the time of purchase.

4.7. Refund Policy: All purchase transactions made through the Services are subject to Lime's return policy in effect at the time of purchase. Currently, Lime's refund policy is to not offer any refunds for any subscriptions purchased through the Services, except in its sole and absolute discretion.

4.8. Order Acceptance Policy: Your receipt of an electronic or other form of order confirmation does not signify our acceptance of Your order, nor does it constitute confirmation of our offer to sell. Lime reserves the right at any time after receipt of Your order to accept or decline Your order for any reason. Lime further reserves the right any time after receipt of Your order, without prior notice to You, to supply

less than the quantity You ordered of any item. Your order will be deemed accepted by Lime upon our delivery of Products and/or Services that You have ordered. We may require additional verifications or information before accepting any order. Notwithstanding the foregoing, You agree that, if We cancel all or a portion of Your order or if We provide You less than the quantity You ordered, Your sole and exclusive remedy is either that: (a) We will issue a credit to Your Card account in the amount charged for the cancelled portion or the quantity not provided (if Your Card has already been charged for the order); or (b) We will not charge Your Card for the cancelled portion of the order or the quantity not provided. Do not assume that a cancellation or change of an order You have placed with Lime has been effected until You receive a confirmation from Lime via email or the Services. As stated above, You will be responsible for, and Your Card or third party payment account may be charged for, the payment of all fees associated with orders already processed or shipped before Your cancellation/change request or a request to terminate Your account was received.

4.9. No Responsibility to Sell Mispriced Products or Services: We do our best to describe every item, product or service offered on the Services as accurately as possible. However, We are human, and therefore We do not warrant that specifications or pricing on the Services is complete, accurate, reliable, current, or error free. In the event of any errors relating to the pricing or specifications of any item, product or service, Lime shall have the right to refuse or cancel any orders in its sole discretion. If We charged Your credit card or other account prior to cancellation, We will issue a credit to Your account in the amount of the charge. Additional terms may apply. If a product You purchased from Lime is not as described, Your sole remedy is to return it in unused condition, complete and undamaged, in the original packaging.

4. 0. Modifications to Prices or Billing Terms: The purchase and/or rental of Products and/or Services is subject to availability. PRODUCTS AND SERVICES DISPLAYED ON THE SERVICES MAY NOT BE AVAILABLE AT ALL TIMES AND MAY BE SUBSTITUTED OR DISCONTINUED AT ANY TIME. LIME RESERVES THE RIGHT, AT ANY TIME, TO CHANGE ITS PRICES AND BILLING METHODS FOR SERVICES, EFFECTIVE IMMEDIATELY UPON POSTING ON THE SERVICES OR BY ELECTRONIC DELIVERY TO YOU.

4. . Account Registration And Security: You understand that You will need to create an account to have access to the Services. You will: (a) provide true, accurate, current and complete information about You as prompted by the Services' registration or subscription page (such information being the "Registration Data") and (b) maintain and promptly update the Registration Data to keep it true, accurate, current and complete. If You provide any information that is untrue, inaccurate, not current or incomplete, or Lime has reasonable grounds to suspect that such information is untrue, inaccurate, not current or incomplete, Lime has the right to suspend or terminate Your account and refuse any and all current or future use of the Services (or any portion thereof). You are entirely responsible for the security and confidentiality of Your password and account. Furthermore, You are entirely responsible for any and all activities that occur under Your account. You will not share Your account information or Your user name and password with any third party or permit any third party to logon to the Services using Your

account information. You agree to immediately notify us of any unauthorized use of Your account or any other breach of security of which You become aware. You are responsible for taking precautions and providing security measures best suited for Your situation and intended use of the Services. We have the right to provide Your billing, account, Content or use records, and related information under certain circumstances (such as in response to legal responsibility, lawful process, orders, subpoenas, or warrants, or to protect our rights, customers or business, or in some cases, as a result of mandatory data sharing with governments). Please note that anyone able to provide Your personally identifiable information will be able to access Your account so You should take reasonable steps to protect this information.

5. RELEASES; DISCLAIMERS; LIMITATION OF LIABILITY; ASSUMPTION OF RISK.

5.1. Releases: “Claims” means, collectively, and without limitation, any and all claims, injuries, demands, liabilities, disputes, causes of action (including statutory, contract, negligence, or other tort theories), proceedings, obligations, debts, liens, fines, charges, penalties, contracts, promises, costs, expenses (including attorneys’ fees, whether incurred pre litigation, pre trial, at trial, on appeal, or otherwise), damages of any kind whatsoever (including consequential, compensatory, or punitive damages), or losses (whether known, unknown, asserted, unasserted, fixed, conditional, or contingent) that arise from or relate to (a) any of the Services, including any of the Products, equipment or related information, and/or (b) Your use of any of the foregoing. “Released Persons” means, collectively Lime and all of its owners, managers, affiliates, employees, agents, representatives, successors, and assigns, and (ii) every sponsor of any of the Services and all of the sponsor’s owners, officers, directors, affiliates, employees, agents, representatives, successors, and assigns. In exchange for being allowed to use any of the Services, and other equipment or related information provided by Lime, You (acting for You and for all of Your family, heirs, agents, affiliates, representatives, successors, and assigns) hereby fully and forever release and discharge all Released Persons for any and all Claims that You have or may have against any Released Person. Such releases are intended to be general and complete releases of all Claims. The Released Persons may plead such releases as a complete and sufficient defense to any Claim, as intended third party beneficiaries of such releases. You expressly agree to indemnify, release and hold harmless Released Persons from all liability for any such property loss or damage, personal injury or loss of life, regardless of the cause, whether based upon breach of contract, breach of warranty, active or passive negligence or any other legal theory, in consideration for using any of the Services.

5.2. Waiver of California Civil Code Section 542: You expressly agree and acknowledge that You may discover facts or law different from, or in addition to, the facts or law that You know or believe to be true with respect to the Claims and the Released Persons. Nonetheless, You expressly agree and acknowledge that Section 5.1 above shall be and remain effective in all respects notwithstanding such different or additional facts or the discovery of them. You expressly agree and acknowledge that all rights under California Civil Code Section 542 are expressly waived. California Civil Code Section 542 provides:

A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS WHICH THE CREDITOR DOES NOT KNOW OR SUSPECT TO EXIST IN HIS OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE, WHICH IF KNOWN BY HIM OR HER MUST HAVE MATERIALLY AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR.

6. DISCLAIMERS.

6.1. Disclaimer of Warranties: TO THE FULLEST EXTENT PERMITTED BY LAW, AND WITH RESPECT TO YOUR USE OF ANY OF THE SERVICES, PRODUCTS, OR RELATED EQUIPMENT, LIME AND ALL OTHER RELEASED PERSONS DISCLAIM ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

6.2. Services Provided As Is: ALL OF THE SERVICES, PRODUCTS, AND RELATED EQUIPMENT ARE PROVIDED “AS IS”, “AS AVAILABLE” AND “WITH ALL FAULTS” (AND YOU RELY ON THEM SOLELY AT YOUR OWN RISK).

Therefore, to the fullest extent permissible by law, the Released Persons hereby disclaim and make no representations, warranties, endorsements, or promises, express or implied, as to:

6.2.1. the Services (including the Products, the Content, the equipment rented through the Services, and the User Submissions);

6.2.2. the functions, features, or any other elements on, or made accessible through, the Services;

6.2.3. any instructions offered or referenced at or linked through the Services;

6.2.4. security associated with the transmission of Your User Submissions transmitted to Lime via the Services;

6.2.5. whether the Services or the servers that make the Services available are free from any harmful components (including viruses, Trojan horses, and other technologies that could adversely impact Your Device(s));

6.2.6. whether the information (including any instructions) on the Services is accurate, complete, correct, adequate, useful, timely, or reliable;

6.2.7. whether any defects to or errors on the Services will be repaired or corrected;

6.2.8. whether Your access to the Services will be uninterrupted;

6.2.9. whether the Services will be available at any particular time or location; and

6.2. 0. whether Your use of the Services is lawful in any particular jurisdiction.

EXCEPT FOR ANY SPECIFIC WARRANTIES PROVIDED HEREIN OR IN ADDITIONAL TERMS PROVIDED BY A RELEASED PERSON, RELEASED PERSONS HEREBY FURTHER DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON INFRINGEMENT OR MISAPPROPRIATION OF INTELLECTUAL PROPERTY RIGHTS OF THIRD PARTIES, TITLE, CUSTOM, TRADE, QUIET ENJOYMENT, SYSTEM INTEGRATION, AND FREEDOM FROM COMPUTER VIRUS.

LIME AND ALL OTHER RELEASED PERSONS DO NOT REPRESENT OR WARRANT THAT ANY OF THE SERVICES, PRODUCTS, OR RELATED EQUIPMENT WILL BE IN GOOD REPAIR OR ERROR FREE, AND DELAYS, OMISSIONS, INTERRUPTIONS, OR INACCURACIES COULD EXIST WITH RESPECT TO ANY OF THE SERVICES, PRODUCTS, AND/OR RELATED EQUIPMENT.

Some jurisdictions limit or do not allow the disclaimer of implied or other warranties so the above disclaimers may not apply to the extent such jurisdictions' laws are applicable. However, in those jurisdictions, Lime expressly disclaims any and all warranties to the fullest extent permitted by applicable law.

7. LIMITED LIABILITY OF LIME; ASSUMPTION OF RISK BY YOU.

7. . Limited Liability: YOU HEREBY ACKNOWLEDGE AND AGREE THAT, EXCEPT AS MAY OTHERWISE BE LIMITED BY LAW, LIME AND ALL OTHER RELEASED PERSONS ARE NOT RESPONSIBLE OR LIABLE FOR ANY CLAIM, INCLUDING THOSE THAT ARISE OUT OF OR RELATE TO (A) ANY RISK, DANGER, OR HAZARD DESCRIBED IN THIS AGREEMENT, (B) YOUR USE OF, OR INABILITY TO USE, ANY OF THE SERVICES, PRODUCTS, AND/OR RELATED EQUIPMENT, (C) YOUR BREACH OF THIS AGREEMENT AND/OR YOUR VIOLATION OF ANY LAW, RULE, REGULATION, AND/OR ORDINANCE, INCLUDING RIDING ON SIDEWALKS AND/OR PARKING, (D) ANY NEGLIGENCE, MISCONDUCT, AND/OR OTHER ACTION AND/OR INACTION BY YOU, (E) YOUR FAILURE TO WEAR A SNELL, CPSC, ANSI OR ASTM APPROVED HELMET THAT HAS BEEN PROPERLY SIZED, FITTED AND FASTENED ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS WHILE USING ANY PRODUCT, AND/OR (F) ANY NEGLIGENCE, MISCONDUCT, AND/OR OTHER ACTION OR INACTION OF ANY THIRD PARTY.

7.2. Waiver of Claims: YOU HEREBY WAIVE ANY AND ALL CLAIMS, INCLUDING THOSE BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STATUTORY, AND/OR OTHER GROUNDS, EVEN IF LIME OR ANY OF THE OTHER RELEASED PERSONS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH CLAIMS.

7.3. Maximum Liability to Lime: THE TOTAL LIABILITY OF LIME AND ALL OTHER RELEASED PERSONS FOR ANY AND ALL CLAIMS, INCLUDING THOSE BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE), STATUTE, OR OTHER GROUNDS, IS LIMITED TO THE SUM OF \$ 00.

7.4. Assumption of Risk by You: YOU HEREBY ACKNOWLEDGE AND AGREE THAT YOUR USE OF ANY OF THE SERVICES, PRODUCTS, AND/OR RELATED EQUIPMENT, IS AT YOUR SOLE AND INDIVIDUAL RISK, AND THAT LIME IS NOT RESPONSIBLE FOR ANY AND ALL CONSEQUENCES, CLAIMS, DEMANDS, CAUSES OF ACTION, LOSSES, LIABILITIES, DAMAGES, INJURIES, FEES, COSTS AND EXPENSES, PENALTIES, ATTORNEYS' FEES, JUDGMENTS, SUITS AND/OR DISBURSEMENTS OF ANY KIND, OR NATURE WHATSOEVER, WHETHER FORESEEABLE OR UNFORESEEABLE, AND WHETHER KNOWN OR UNKNOWN. YOU EXPRESSLY AGREE AND ACKNOWLEDGE THAT YOU FULLY UNDERSTAND THE RISKS ASSOCIATED WITH YOUR USE OF THE SERVICES, PRODUCTS, AND/OR RELATED EQUIPMENT, AND THAT YOU ASSUME SUCH RISK.

7.4. . You are solely and fully responsible for the safe operation of the Products at all times.

7.4.2. You agree that the Products are machines that may malfunction, even if the Products are properly maintained, and that such malfunction may cause injury.

7.4.3. You agree that riding the Products involves many obvious and not so obvious risks, dangers, and hazards, which may result in injury or death to You or others, as well as damage to property, and that such risks, dangers, and hazards cannot always be predicted or avoided.

7.4.4. You agree that such risks, dangers, and hazards are Your sole responsibility, including, but not limited to, choosing whether to wear a helmet other protective gear. Lime advises You to wear a Snell, CPSC, ANSI or ASTM approved helmet that has been properly sized, fitted and fastened according to the manufacturer's instructions at all times while using any of the Products, whether required by law or not. You expressly understand and agree that it is solely Your responsibility to determine whether You are required to wear a helmet in the particular jurisdiction in which You are using the Products. If You do not wear a Snell, CPSC, ANSI or ASTM approved helmet that has been properly sized, fitted and fastened according to the manufacturer's instructions, You do so at Your own risk.

7.4.5. You agree that if Your use of any of the Services, Products, and/or related equipment causes any injury or damage to another person or property, then You will be liable for any and all consequences, claims, demands, causes of action, losses, liabilities, damages, injuries, fees, costs and expenses, penalties, attorneys' fees, judgments, suits and/or disbursements of any kind, or nature whatsoever, whether foreseeable or unforeseeable, and whether known or unknown.

8. INDEMNIFICATION.

8. . Indemnification: You agree to defend, indemnify, and hold harmless the Released Persons from and against any and all consequences, claims, demands, causes of action, losses, liabilities, damages, injuries, fees, costs and expenses, penalties, attorneys' fees, judgments, suits settlements, and/or

disbursements of any kind, or nature whatsoever, whether foreseeable or unforeseeable, and whether known or unknown, that directly or indirectly arise from or are related to any claim, suit, action, demand, or proceeding made or brought against any Released Person, or on account of the investigation, defense, or settlement thereof, arising out of or in connection with, whether occurring heretofore or hereafter: (i) Your use or misuse of the Services, Products, and/or related equipment, (ii) Your User Submissions; (iii) Your use of the Services and Your activities in connection with the Services; (iv) Your breach or alleged breach of this Agreement or any Additional Terms; (v) Your violation or alleged violation of any laws, rules, regulations, codes, statutes, ordinances, or orders of any governmental or quasi governmental authorities in connection with Your use of the Services (including the Products) or Your activities in connection with the Services; (vi) information or material transmitted through Your Device(s), even if not submitted by You, that infringes, violates, or misappropriates any copyright, trademark, trade secret, trade dress, patent, publicity, privacy, or other right of any person or entity; (vii) any misrepresentation made by You; and (viii) the Released Persons' use of the information that You submit to Us (including Your User Submissions) (all of the foregoing, "Claims and Losses"). You will cooperate as fully required by the Released Persons in the defense of any of the foregoing. Notwithstanding the foregoing, the Released Persons retain the exclusive right to settle, compromise, and pay any and all Claims and Losses. Released Persons reserve the right to assume the exclusive defense and control of any Claims and Losses. You will not settle any Claims and Losses without, in each instance, the prior written consent of an officer of a Released Persons.

9. TERM AND TERMINATION.

9.1. Term: The term of this Agreement begins when You first use the Services, and the term ends 0 years after You last use the Services; provided, however, that Your personal financial responsibility under this Agreement expires one year after You last use the Services.

9.2. Termination by Lime: At any time and from time to time, and without Your consent, Lime may unilaterally terminate Your right to use the Services, in Lime's sole discretion and without any notice or cause. You may terminate Your use of the Services at any time; provided, however, that (i) no refund will be provided by Lime, (ii) the term of this Agreement continues in accordance with this Agreement, and (iii) You may still be charged any applicable fees in accordance with this Agreement.

9.2. This Agreement remains in full force and effect, in accordance with its terms and conditions, after any termination of Your right to use any of the Services, regardless of how the Agreement is terminated.

10. CONFIDENTIALITY OF INFORMATION; PRIVACY POLICIES.

10.1. Information Kept According to Privacy Policy: All personally identifiable information that is held by Lime and pertains to You, including all names, addresses, phone numbers, email addresses, Card numbers, and/or pass numbers, will be kept by Lime in accordance with its Privacy Policy; provided,

however, that (i) if there is any situation where You are unable to communicate personal information to the appropriate authorities, then Lime may, in its sole discretion, provide Your name, address, phone number, and other information to such authorities, (ii) if Lime receives a subpoena from any court or other authority, then Lime will provide all requested information in accordance with applicable law, and (iii) Lime may disclose aggregate and other data about You in accordance with applicable law, including, without limitation, general latitude and longitude data for Your addresses (provided this would not allow any individual's address to be separately identified). In addition, Lime may disclose individual data to a third party upon Your express permission and consent (e.g. enrollment in a study).

0.2. Reservation of Rights: We reserve the right, without any limitation, to: (i) investigate any suspected breaches of the Services' security or information technology or other systems or networks; (ii) investigate any suspected breaches of this Agreement and any Additional Terms; (iii) investigate any information obtained by us in connection with reviewing law enforcement databases or complying with criminal laws; (iv) involve and cooperate with law enforcement authorities in investigating any of the foregoing matters; (v) prosecute violators of this Agreement and any Additional Terms; and (vi) discontinue the Services, in whole or in part, or, except as may be expressly set forth in any Additional Terms, suspend or terminate Your access to it, in whole or in part, including any user accounts or registrations, at any time, without notice, for any reason and without any obligation to You or any third party. Any suspension or termination will not affect Your obligations to us under this Agreement or any Additional Terms. Upon suspension or termination of Your access to the Services, or upon notice from us, all rights granted to You under this Agreement or any Additional Terms will cease immediately, and You agree that You will immediately discontinue use of the Services. The provisions of this Agreement and any Additional Terms, which by their nature should survive Your suspension or termination will survive, including the rights and licenses You grant to us in this Agreement, as well as the indemnities, releases, disclaimers, and limitations on liability and the provisions regarding jurisdiction, choice of law, no class action, and mandatory arbitration.

. ADDITIONAL TERMS OF USE.

. . Safety Check: Before each use of any Product, You shall conduct a basic safety inspection of the Product, which includes inspecting the following: (i) trueness of the wheels; (ii) safe operation of all brakes and lights; (iii) proper attachment of the seat, pedals, and basket; (iv) good condition of the frame; (v) sufficient of battery charge power; and (vi) any sign of damage, unusual or excessive wear, or other mechanical problem or maintenance need. You agree not to ride the Product if there are any noticeable issues, and to immediately notify customer service to alert Lime of any problems.

. . . If at any time, whether prior to, during, or after riding any Product, You discover any defect or notice any other potentially unsafe condition on any Product, no matter how slight, You must not use the Product, or, if You are already riding the Product, You must immediately cease riding when it is safe to do so.

. .2. You agree to immediately report the defect or condition to Lime.

. .3. If You do not strictly comply with the aforementioned requirements, You shall be totally and completely liable for any and all consequences, claims, demands, causes of action, losses, liabilities, damages, injuries, fees, costs and expenses, penalties, attorneys' fees, judgments, suits settlements, and/or disbursements of any kind, or nature whatsoever, whether foreseeable or unforeseeable, and whether known or unknown, and You shall indemnify and hold harmless Lime for the same.

.2. Lost or Stolen Products: If a Product is not returned within 48 consecutive hours, then the Product may be deemed lost or stolen, in Lime's sole discretion, and a police report may be filed against You with local authorities. The data generated by the Services' computer is conclusive evidence of the period of use of the Products by You. You must report any disappearance or theft of any Product to Lime immediately or as soon as possible.

.3. Helmets; Safety: Lime advises You to wear a helmet at all times while using any of the Services, Products, and/or related equipment, whether required by law or not.

.3. . Lime recommends that You wear a Snell, CPSC, ANSI or ASTM approved helmet that has been properly sized, fitted and fastened according to the manufacturer's instructions.

.3.2. If wearing a helmet is required by the laws, rules, regulations and/or ordinances applicable to the area in which the Product is operated, You agree to comply with such laws and regulations at all times.

.3.3. You agree that neither Lime nor the Released Persons are liable for any injury or death suffered by You while using the Services, whether or not You are wearing a helmet at the time of injury.

.3.4. You expressly acknowledge and agree that You may need to take additional safety measures or precautions not specifically addressed in this Agreement, and You expressly acknowledge and agree that determining whether You must do so is Your sole responsibility not Lime's responsibility.

.4. Routes: You agree that Lime does not provide or maintain places to ride the Products, and that Lime does not guarantee that there will always be a safe place to ride any particular Product. Roads, bicycle lanes, and routes may become dangerous due to weather, traffic, and/or other hazards outside of Lime's control. Lime shall not be liable for any of the foregoing, without limitation. You are solely responsible for choosing a responsible and safe route. You must obey all laws at all times in choosing a route, and it is Your sole responsibility to be familiar with the applicable laws, rules, regulations, and/or ordinances of the jurisdiction in which You are using Lime's Services and/or Products.

.5. Limitations on Rental. You agree that Lime is not a common carrier. Alternative means of public and private transportation are available to the general public and to You individually. Lime provides the Services and Products only as a convenience, and such rental availability is intended to be used only by those persons who are able and qualified to operate the Products on their own and who have agreed to all terms and conditions of this Agreement.

.6. Limitation on Availability of Services: Lime makes every effort to provide the Services 365 days per year, but We do not guarantee that the Services will be available at all times, as force majeure events or other circumstances might prevent Lime from providing the Services. Access to the Services is also conditioned on the availability of Products. Lime does not represent or warrant the availability of any Services or the availability of any Products at any time. You agree that Lime may require You to return a Product at any time

.7. License to Image and Likeness: For good and valuable consideration, the receipt and adequacy of which are hereby acknowledged, You do hereby knowingly, voluntarily, and irrevocably: () give Your full and unconditional consent to Lime and its affiliates, successors, and assigns to use at any time and from time to time, without any restriction, Your appearance and voice in photographs, videos, and other recordings related to Your use of the Services, on all websites and for all press, promotional, advertising, publicity, and other commercial purposes, including all formats and media, whether now known or hereafter devised, throughout the world and in perpetuity; (2) grant to Lime and its affiliates, successors, and assigns (a) the right to photograph, videotape, and otherwise record Your appearance and voice related to Your use of the Services, at any time and from time to time, (b) all rights, copyrights, title, and interests in the results of such photographs, videos, and other recordings, as a work for hire for copyright purposes, and (c) the right to use, reproduce, exhibit, distribute, transmit, alter, and exploit, at any time and from time to time and as Lime may decide in its sole discretion, such photographs, videos, and other recordings, or any component thereof, and all related merchandising, promotions, advertising, and publicity; and (3) waive, release, and discharge Lime and all Released Persons from all Claims that You have or may have for any libel, defamation, invasion of privacy, right of publicity, infringement of copyright, or violation of any right granted by You in this paragraph.

.8. Access License: Subject to Your strict compliance with this Agreement and the Additional Terms, Lime grants You a limited, revocable, non exclusive, non assignable, non transferable license to download (temporary storage only), display, view, use, play, and/or print one copy of the Content (excluding source and object code in raw form or otherwise, other than as made available to access and use to enable display and functionality) on a personal computer, mobile phone or other wireless Device, or other Internet enabled Device (each, a “Device”) for Your personal, non commercial use only. This license does not include any resale or commercial use of the Services or its contents; any collection and use of any product listings, descriptions, or prices; any derivative use of the Services or their contents; any downloading or copying of account information for the benefit of another merchant; or any use of data mining, robots, or similar data gathering and extraction tools. Except as expressly permitted herein,

the Services and/or any portion of the Services may not be reproduced, sold, resold, visited or otherwise exploited for any purpose without Lime's express written consent. Any unauthorized use automatically terminates the permissions and/or licenses granted by Us to You. The foregoing limited license: (i) does not give You any ownership of, or any other intellectual property interest in, any Content, and (ii) may be immediately suspended or terminated for any reason, in Lime's sole discretion, and without advance notice or liability.

.9. Copyright and Ownership: All of the content featured or displayed on the Services, including, without limitation, text, graphics, photographs, images, moving images, sound, and illustrations ("Content"), is owned by Lime, its licensors, vendors, agents and/or its Content providers. All elements of the Services, including, without limitation, the general design and the Content, are protected by trade dress, copyright, moral rights, trademark and other laws relating to intellectual property rights. The Services may only be used for the intended purpose for which such Services is being made available. Except as permitted by copyright law, You may not modify any of the materials and You may not copy, distribute, transmit, display, perform, reproduce, publish, license, create derivative works from, transfer or sell any information or work contained on the Services. Except as authorized under the copyright laws, You are responsible for obtaining permission before reusing any copyrighted material that is available on the Services. You shall comply with all applicable domestic and international laws, statutes, ordinances and regulations regarding Your use of the Services. The Services, its Content and all related rights shall remain the exclusive property of Lime or its licensors, vendors, agents, and/or its Content providers unless otherwise expressly agreed. You will not remove any copyright, trademark or other proprietary notices from material found on the Services.

. 0. Trademarks/No Endorsement: All trademarks, service marks and trade names of Lime used herein (including but not limited to: LimeBike name, LimeBike corporate logo, Lime name, Lime corporate logo, the Services name, the Services design, and/or any logos) (collectively "Marks") are trademarks or registered trademarks of Lime or its affiliates, partners, vendors or licensors. You may not use, copy, reproduce, republish, upload, post, transmit, distribute, or modify Lime trademarks in any way, including in advertising or publicity pertaining to distribution of materials on the Services, without Lime's prior written consent. You shall not use Lime's name or any language, pictures or symbols which could, in Lime's judgment, imply Lime's endorsement in any (i) written or oral advertising or presentation, or (ii) brochure, newsletter, book, or other written material of whatever nature, without prior written consent.

. . Solicited Submission Policy: Where Lime has specifically invited or requested submissions or comments, Lime encourages You to submit content (e.g., comments to blog posts, participation in communities, tips, etc.) to Lime that they have created for consideration in connection with the Site ("User Submissions"). User Submissions remains the intellectual property of the individual user. By posting content on our Site, You expressly grant Lime a non exclusive, perpetual, irrevocable, royalty free, fully paid up, worldwide, fully sub licensable right and license to use, reproduce, modify,

adapt, publish, translate, create derivative works from, distribute, transmit, perform and display such content and Your name, voice, and/or likeness as contained in Your User Submission, in whole or in part, and in any form throughout the world in any media or technology, whether now known or hereafter discovered, including all promotion, advertising, marketing, merchandising, publicity and any other ancillary uses thereof, and including the unfettered right to sublicense such rights, in perpetuity throughout the universe. Any such User Submissions are deemed non confidential and Lime shall be under no obligation to maintain the confidentiality of any information, in whatever form, contained in any User Submission.

. 2. Inappropriate User Submissions: Lime does not encourage, and does not seek, User Submissions that result from any activity that: (i) may create a risk of harm, loss, physical or mental injury, emotional distress, death, disability, disfigurement, or physical or mental illness to You, to any other person, or to any animal; (ii) may create a risk of any other loss or damage to any person or property; or (iii) may constitute a crime or tort. You agree that You have not and will not engage in any of the foregoing activities in connection with producing Your User Submission. Without limiting the foregoing, You agree that in conjunction with Your submission, You will not inflict emotional distress on other people, will not humiliate other people (publicly or otherwise), will not assault or threaten other people, will not enter onto private property without permission, will not impersonate any other person or misrepresent Your affiliation, title, or authority, and will not otherwise engage in any activity that may result in injury, death, property damage, and/or liability of any kind. Lime will reject any User Submissions in which Lime believes, in its sole discretion, that any such activities have occurred. If notified by You of a submission that allegedly violates any provision of this Agreement, Lime reserves the right to determine, in its sole discretion, if such a violation has occurred, and to remove any such submission from the Services at any time and without notice.

. 3. Inappropriate Material: You are prohibited from using the Services to post or send any unlawful, infringing, threatening, defamatory, libelous, obscene, pornographic or profane material or any material that infringes or misappropriates third party intellectual property or could constitute or encourage conduct that would be considered a criminal offense or otherwise violate any law. You further agree that sending or posting unsolicited advertisements or “spam” on or through the Services is expressly prohibited by this Agreement. In addition to any remedies that We may have at law or in equity, if We determine, in our sole discretion, that You have violated or are likely to violate the foregoing prohibitions or any applicable rules or policies linked to in these Agreement, We may take any action We deem necessary to cure or prevent the violation, including, without limitation, banning You from using the Services and/or the immediate removal of the related materials from the Services at any time without notice. We will fully cooperate with any law enforcement authorities or court order or subpoena requesting or directing us to disclose the identity of anyone posting such materials.

. 4. Access and Interference: You agree that You will not use any robot, spider, scraper or other automated means to access the Services for any purpose without our express written permission.

Additionally, You agree that You will not: (i) take any action that imposes, or may impose, in our sole discretion an unreasonable or disproportionately large load on our infrastructure; (ii) interfere or attempt to interfere with the proper working of the site or any activities conducted on the Services; or (iii) bypass any measures We may use to prevent or restrict access to the Services.

. 5. Right to Takedown Content: Except as disclosed in our Privacy Policy, We will not monitor, edit, or disclose the contents of Your e mail or Content posted to the Services unless required in the course of normal maintenance of the Services and its systems or unless required to do so by law or in the good faith belief that such action is necessary to: () comply with the law or comply with legal process served on Lime or the Services; (2) protect and defend the rights or property of Lime, the Services, or the users of the Services; or (3) act in an emergency to protect the personal safety of our users, the Services, or the public. Users shall remain solely responsible for the content of their messages and Lime shall have no obligation to prescreen any such content. However, We shall have the right in our sole discretion to edit, refuse to post or remove any material submitted to or posted on the Services at any time without notice. Without limiting the foregoing, We shall have the right to remove any material that We find to be in violation of the provisions hereof or otherwise objectionable, and the additional right to deny any user who fails to conform to any provision of these Agreement access to the Services or any part thereof.

. 6. User Published Content: User published Content and User Submissions do not represent the views of Lime or any individual associated with Lime, and We do not control this Content. In no event shall You represent or suggest, directly or indirectly, Lime's endorsement of user published Content. Lime does not vouch for the accuracy or credibility of any user published Content on our Services or User Submissions published through our Services, and do not take any responsibility or assume any liability for any actions You may take as a result of reviewing any such user published Content or User Submission. Through Your use of the Services and Services, You may be exposed to Content that You may find offensive, objectionable, harmful, inaccurate or deceptive. There may also be risks of dealing with underage persons, people acting under false pretense, international trade issues and foreign nationals. By using our Services, You assume all associated risks.

. 7. Third Party Links: From time to time, the Services may contain links to websites that are not owned, operated or controlled by Lime or its affiliates. All such links are provided solely as a convenience to You. If You use these links, You will leave the Services. Neither We nor any of our respective affiliates are responsible for any content, materials or other information located on or accessible from any other website. Neither We nor any of our respective affiliates endorse, guarantee, or make any representations or warranties regarding any other websites, or any content, materials or other information located or accessible from any other websites, or the results that You may obtain from using any other websites. If You decide to access any other websites linked to or from the Services, You do so entirely at Your own risk.

. 8. Transactional Partners: In some cases, We partner with another company to co promote their services within our Services. In these cases, You are transacting directly with the other party. On those pages or locations, the transactional partners' brand is clearly visible and their Agreement are posted. When using these partner pages, You are bound by the partner Agreement in addition to remaining bound by this Agreement. When there is a conflict between this Agreement and the partner's agreement, Our Agreement will prevail.

. 9. Termination: You or We may suspend or terminate Your right to use of the Services at any time, for any reason or for no reason. We may also block Your access to our Services in the event that (a) You breach these Agreement; (b) We are unable to verify or authenticate any information You provide to us; or (c) We believe that Your actions may cause financial loss or legal liability for You, our users or us.

.20. Representations and Warranties: You represent that You are over the age of 18, have the right and authority to enter into this Agreement, are fully able and competent to satisfy the terms, conditions, and obligations herein, and Your use of the Services is and will be in compliance with all applicable laws. You represent that You have read, understood, agree with, and will abide by the terms of this Agreement. In addition, You represent and warrant that Your User Submissions and all elements thereof are (a) owned or controlled solely and exclusively by You, You have prior written permission from the rightful owner of the content included in Your User Submissions, or You are otherwise legally entitled to grant Lime all of the rights granted herein; and (b) Lime's use of Your User Submissions as described or contemplated herein do not and will not infringe on the copyrights, trademark rights, publicity rights or other rights of any person or entity, violate any law, regulation or right of any kind whatsoever, or otherwise give rise to any actionable claim or liability, including, without limitation, rights of publicity and privacy, and defamation. Furthermore, You shall be solely responsible for Your own User Submissions and the consequences of posting or publishing them.

.2 . Wireless Features: The Services may offer certain features and services that are available to You via Your wireless Device. These features and services may include the ability to access the Services' features and upload content to the Services, receive messages (including text and SMS messages) from the Services, and download applications to Your wireless Device (collectively, "Wireless Features"). Standard messaging, data, and other fees may be charged by Your carrier to participate in Wireless Features. Fees and charges may appear on Your wireless bill or be deducted from Your pre paid balance. Your carrier may prohibit or restrict certain Wireless Features and certain Wireless Features may be incompatible with Your carrier or wireless Device. You should check with Your carrier to find out what plans are available and how much they cost. Contact Your carrier with questions regarding these issues. You confirm that You are the current subscriber and/or customary user of the mobile number registered with the Services and authorized to incur any message or data charges that may be charged by Your carrier. You are strictly prohibited from registering a mobile number that is not Your own. If We discover that any information provided is false or inaccurate, We may hold, suspend or terminate Your access to the Services at any time. Your consent to receive mobile messages from Lime is not a condition of any

purchase. Your participation in the Services are completely voluntary. You consent to receive mobile messages using automated technology, including through an automatic telephone dialing system or autodialer.

.2 . . . You agree that as to the Wireless Features for which You are registered, We may send communications to Your wireless Device regarding us or other parties. Further, We may collect information related to Your use of the Wireless Features. If You have registered via the Services for Wireless Features, then You agree to notify us of any changes to Your wireless contact information (including phone number) and update Your accounts on the Services to reflect the changes.

.2 .2. You may revoke consent or opt out from receiving mobile text/SMS messages at any time by texting STOP. You may also opt out at any time by texting the word REMOVE, CANCEL, OPT OUT, UNSUBSCRIBE, END, or QUIT. You consent to receive an additional text message confirming Your opt out request. For help, send a text message with the keyword HELP. Please allow up to five (5) business days to process Your opt out request. It is Your sole obligation to notify Lime that You do not want to receive mobile messages by following the instructions in this Section. You waive any rights to bring claims for unauthorized or undesired text messages by failing to opt out immediately.

.2 .3. If You relinquish ownership of the mobile number associated with Your text subscription, You agree to immediately notify Lime by texting STOP or by calling Customer Service. If You change any of Your contact information, You agree to immediately notify Lime by calling Customer Service. You agree to indemnify, defend and hold Lime harmless for any privacy, tort or other claims, including claims under the Federal Telephone Consumer Protection Act ("TCPA") or its state law equivalent, relating to Your provision of a mobile number that is not owned by You and/or Your failure to notify Lime of any changes in mobile ownership or Your contact information. You must notify Lime immediately of any breach of security or unauthorized use of Your mobile phone. Although Lime will not be liable for Your losses caused by any unauthorized use of Your mobile Device, You may be liable for the losses of Lime or others due to such unauthorized use.

.22. Force Majeure: Neither Lime nor You shall be responsible for damages or for delays or failures in performance resulting from acts or occurrences beyond their reasonable control, including, without limitation: fire, lightning, explosion, power surge or failure, water, acts of God, war, revolution, civil commotion or acts of civil or military authorities or public enemies: any law, order, regulation, ordinance, or requirement of any government or legal body or any representative of any such government or legal body; or labor unrest, including, without limitation, strikes, slowdowns, picketing, or boycotts; inability to secure raw materials, transportation facilities, fuel or energy shortages, or acts or omissions of common carriers.

.23. General: This Agreement and any Additional Terms will be governed by and construed in accordance with, and any Dispute and Excluded Dispute will be resolved in accordance with, the laws of

the State of California, without regard to its conflicts of law provisions. A printed version of this Agreement will be admissible in judicial and administrative proceedings based upon or relating to this Agreement to the same extent and subject to the same conditions as other business documents and records originally generated and maintained in printed form. When You communicate with us electronically, such as via e mail and text message, You consent to receive communications from us electronically. Please note that We are not obligated to respond to inquiries that We receive. You agree that all agreements, notices, disclosures, and other communications that We provide to You electronically satisfy any legal requirement that such communications be in writing. These Agreement set forth the entire understanding and agreement between us with respect to the subject matter hereof. We do not guarantee continuous, uninterrupted or secure access to our Services, and operation of the Services may be interfered with by numerous factors outside of our control. If any provision of these Agreement is held to be invalid or unenforceable, such provision shall be struck and the remaining provisions shall be enforced. You agree that this Agreement and all incorporated agreements may be automatically assigned by Lime in our sole discretion. Headings are for reference purposes only and in no way define, limit, construe or describe the scope or extent of such section. Our failure to act with respect to a breach by You or others does not waive our right to act with respect to subsequent or similar breaches. All sections which by their context ought to survive this Agreement shall survive any termination or expiration of this Agreement. To the extent permitted by applicable law, You agree to waive, and You hereby waive, any applicable statutory and common law that may permit a contract to be construed against its drafter. Except as expressly set forth in this Agreement or any Additional Terms, (i) no failure or delay by You or us in exercising any of rights, powers, or remedies under will operate as a waiver of that or any other right, power, or remedy, and (ii) no waiver or modification of any term of this Agreement or any Additional Terms will be effective unless in writing and signed by the party against whom the waiver or modification is sought to be enforced. You are responsible for obtaining and maintaining all Devices and other equipment and software, and all internet service provider, mobile service, and other services needed for Your access to and use of the Services and You will be responsible for all charges related to them. Lime controls and operates the Services from its U.S. based offices in the U.S.A., and Lime makes no representation that the Services is appropriate or available for use beyond the U.S.A. If You use the Services from other locations, You are doing so on Your own initiative and are responsible for compliance with applicable local laws regarding Your online conduct and acceptable content, if and to the extent local laws apply. The Services may describe products and services that are available only in the U.S.A. (or only parts of it) and are not available worldwide. We reserve the right to limit the availability of the Services and/or the provision of any content, program, product, service, or other feature described or available on the Services to any person, entity, geographic area, or jurisdiction, at any time and in our sole discretion, and to limit the quantities of any content, program, product, service, or other feature that We provide. You and We disclaim any application to this Agreement of the Convention on Contracts for the International Sale of Goods.

.24. Digital Millennium Copyright Act (“DMCA”) Notice: In operating the Services, We may act as a “services provider” (as defined by DMCA) and offer services as online provider of materials and links to

third party websites. As a result, third party materials that We do not own or control may be transmitted, stored, accessed or otherwise made available using the Services. Lime has in place certain legally mandated procedures regarding allegations of copyright infringement occurring on the Services. Lime has adopted a policy that provides for the immediate removal of any content or the suspension of any user that is found to have infringed on the rights of Lime or of a third party, or that has otherwise violated any intellectual property laws or regulations, or any of the terms and conditions of this Agreement. If You believe any material available via the Services infringe a copyright, You should notify us using the notice procedure for claimed infringement under the DMCA (17 U.S.C. Sect. 512(c)(2)). We will respond expeditiously to remove or disable access to the material claimed to be infringing and will follow the procedures specified in the DMCA to resolve the claim between the notifying party and the alleged infringer who provided the Content. Our designated agent (i.e., proper party for notice) to whom You should address infringement notices under the DMCA is [REDACTED] and cc [REDACTED].

.24. . Please provide the following notice:

.24. . . Identify the copyrighted work or other intellectual property that You claim has been infringed;

.24. .2. Identify the material on the Services that You claim is infringing, with enough detail so that We may locate it on the Services;

.24. .3. A statement by You that You have a good faith belief that the disputed use is not authorized by the copyright owner, its agent, or the law;

.24. .4. A statement by You declaring under penalty of perjury that (a) the above information in Your notice is accurate, and (b) that You are the owner of the copyright interest involved or that You are authorized to act on behalf of that owner;

.24. .5. Your address, telephone number, and email address; and

.24. .6. Your physical or electronic signature.

.24.2. We may give notice to our users of any infringement notice by means of a general notice on any of our Services, electronic mail to a user's e mail address in our records, or by written communication sent by first class mail to a user's physical address in our records. If You receive such an infringement notice, You may provide counter notification in writing to the designated agent that includes the information below. To be effective, the counter notification must be a written communication that includes the following:

.24.2. . Your physical or electronic signature;

.24.2.2. Identification of the material that has been removed or to which access has been disabled, and the location at which the material appeared before it was removed or access to it was disabled;

.24.2.3. A statement from You under the penalty of perjury, that You have a good faith belief that the material was removed or disabled as a result of a mistake or misidentification of the material to be removed or disabled; and

.24.2.4. Your name, physical address and telephone number, and a statement that You consent to the jurisdiction of a Federal District Court for the judicial district in which Your physical address is located, or if Your physical address is outside of the United States, for any judicial district in which We may be found, and that You will accept service of process from the person who provided notification of allegedly infringing material or an agent of such person.

.25. Updates to Terms: AS OUR SERVICES EVOLVE, THE TERMS AND CONDITIONS UNDER WHICH WE OFFER SERVICES MAY BE MODIFIED. AS SUCH, YOU EXPRESSLY AGREE TO THE FOLLOWING:

.25. . We may cease offering the Services under the terms or Additional Terms for which they were previously offered.

.25.2. Each time you use the Services you are entering into a new agreement with us on the then applicable terms and conditions.

.25.3. You agree that we may notify you of any updated terms by posting a link to the then current version of this Agreement on the App, the Services, and/or in any other reasonable manner of notice which we elect.

.25.4. Your use of the Services after such notice constitutes Your going forward agreement to the revised agreement.

.25.5. You will review the posted user agreement/terms of service and any applicable Additional Terms each time You use the Services.

.25.6. You agree that the revised Agreement will be effective as to new use and transactions as of the time that We post them, or such later date as may be specified in them or in any other notice to You.

.25.7. This Agreement (and any applicable Additional Terms) that applied when You previously used the Services will continue to apply to such prior use (i.e., changes and additions are prospective only) unless mutually agreed.

.25.8. In the event any notice to You of new, revised or Additional Terms is determined to be insufficient, the prior agreement between You and Us shall continue until sufficient notice to establish a new agreement occurs.

.25.9. You should frequently check the App, the home page, and the e mail You associated with Your account for notices, all of which You agree are reasonable manners of providing You notice.

.25. 0. You can reject any new, revised or Additional Terms by discontinuing use of the Services and related services.

.26. Additional Assistance. If You do not understand any of the foregoing Agreement or if You have any questions or comments, We invite You to contact Us at [REDACTED] and cc [REDACTED]. By signing up for the Services, You agree that: (i) We may give You notices of important matters by prominently posting notice on the home page of the Services or in another reasonable manner We determine in our sole discretion; and (ii) We may contact You and send You communications by postal mail and e mail at the addresses provided in Your account. These communications may include marketing communications about the Services as well as other promotional offers unrelated to the Services and You consent to receive these communications from us even if You previously indicated to us that You no longer wanted to receive communications from us. Your sign up to the Services will serve as Your express agreement to receive these marketing and similar communications from us. You may prospectively modify certain types of email communications that You receive from us relating to the Services by following the instructions contained within such emails. Such changes will only impact our email communications to the extent described in the modification process. You agree to promptly notify us if You change Your e mail or mailing address by updating Your account.

.27. Copyright Notice: All design, graphics, text selections, arrangements, and all software are Copyright © 20 8, Neutron Holdings, Inc. and its related companies or its licensors. ALL RIGHTS RESERVED.

.28. Terms Applicable For Apple iOS: If You are accessing or using our Services through a Device manufactured and/or sold by Apple, Inc. ("Apple", with such a Device herein referenced as an "Apple Device"):

.28. . To the extent that You are accessing the App through an Apple Device, You acknowledge that this Agreement entered into between You and Lime and, that Apple is not a party to this Agreement other than as third party beneficiary as contemplated below.

.28.2. Any license(s) granted to You in this Agreement is subject to the permitted Usage Rules set forth in the Apple App Store Terms and Conditions (see: <http://www.apple.com/legal/itunes/us/terms.html>) and any third party terms of agreement applicable to the App.

.28.3. You acknowledge that Lime, and not Apple, is responsible for providing the App and Content thereof.

.28.4. You acknowledge that Apple has no obligation whatsoever to furnish any maintenance or any support services to You with respect to the App.

.28.5. To the maximum extent permitted by applicable law, Apple will have no other warranty obligation whatsoever with respect to the App.

.28.6. Notwithstanding anything to the contrary herein, and subject to the terms in this Agreement, You acknowledge that, solely as between Apple and Lime, Lime and not Apple is responsible for addressing any claims You may have relating to the App, or Your possession and/or use thereof, including, but not limited, to: (i) product liability claims, (ii) any claim that the App fails to conform to any applicable legal or regulatory requirement; and (iii) claims arising under consumer protection or similar legislation.

.28.7. Further, You agree that if the App, or Your possession and use of the App, infringes on a third party's intellectual property rights, You will not hold Apple responsible for the investigation, defense, settlement and discharge of any such intellectual property infringement claims.

.28.8. You acknowledge and agree that Apple, and Apple's subsidiaries, are third party beneficiaries of this Agreement, and that, upon Your acceptance of the terms and conditions of this Agreement, Apple will have the right (and will be deemed to have accepted the right) to enforce this Agreement against You as a third party beneficiary thereof.

.28.9. When using the App, You agree to comply with any and all third party terms that are applicable to any platform, website, technology or service that interacts with the App.

.28. 0. You represent and warrant that: (i) You are not located in a country that is subject to a U.S. Government embargo or that has been designated by the U.S. Government as a "terrorist supporting" country; and (ii) You are not listed on any U.S. Government list of prohibited or restricted parties.

.29. Google Maps: The map data that We provide to You in our App is based on the current map information available to us which may be provided by a third party such as through the incorporation of

the Google Maps API, and may be inaccurate or incomplete. If You utilize map functionality We make available through our App, You acknowledge and agree to be bound by Google, Inc.'s Google Maps/Google Earth Additional Terms of Service, available at https://maps.google.com/help/terms_maps.html.

.30. California Consumer Rights: Residents of California are entitled to the following specific consumer rights information: You may contact the Complaint Assistance Unit of the Division of Consumer Services of the Department of Consumer Affairs by mail at: 400 R St., Suite 080, Sacramento, California, 958 4, or by telephone at (9 6) 445 254. Their website is located at: <http://www.dca.ca.gov>.

ACCEPTANCE OF AGREEMENT

I certify that I am at least 8 years old, and that I have read and expressly agree to the terms and conditions set forth in this Agreement, including specifically, the arbitration and class action waiver provisions.

OR

I certify that I am the parent and/or legal guardian of the minor User, who is at least 3 years old, and that I am at least 8 years old. I have read, and I expressly agree to, the terms and conditions set forth in this Agreement, including specifically, the arbitration and class action waiver provisions. I authorize use of the Services by the minor User through my account. I will supervise and ensure that the minor User complies with all of the terms set forth in this Agreement and I expressly agree to indemnify and hold Lime harmless against any and all misuse, consequences, claims, demands, causes of action, losses, liabilities, damages, injuries, fees, costs and expenses, penalties, attorneys' fees, judgments, suits and/or disbursements of any kind, or nature whatsoever, whether foreseeable or unforeseeable, and whether known or unknown, as a result of the minor's use of the Bike and/or any of the Services. I further expressly guarantee the minor's acceptance of the terms of this Agreement, and I will be responsible for any breach of the above representations, warranties and/or this Agreement, and/or any attempt of the minor to disaffirm this Agreement.

Appendix E: Privacy Policy

Last Changes to Privacy Policy: March 5, 2017

We are strongly committed to letting you know how we will collect and use your personal information. The policies below are applicable to data and information collected when you use the Neutron Holdings, Inc. network of websites, including www.LimeBike.com (including any versions optimized for viewing on a wireless or tablet device); all email newsletters published or distributed by Neutron Holdings, Inc.; all apps published by Neutron Holdings, Inc., including the “LimeBike” app; activate a LimeBike bicycle (“Bike”) or use any other services made available by Neutron Holdings, Inc. (“Service”) and all other interactive features and communications provided by Neutron Holdings, Inc. (“App”), however accessed and/or used, that are operated by us, made available by us, or produced and maintained by us and our related companies (collectively “LimeBike” or “we”, “us”, or “our”). We have established this privacy policy (“Privacy Policy”) to let you know the kinds of personal information we may gather during your use of this App, why we gather your information, what we use your personal information for, when we might disclose your personal information, and how you can manage your personal information.

Please be advised that the practices described in this Privacy Policy apply to information gathered online through our App, through our websites and otherwise by our customer service personnel. It does not apply to information that you may submit to organizations to which we may link or who may link to us or information that we may receive about you from other organizations.

By using our App, you are accepting the practices described in our Privacy Policy. If you do not agree to the terms of this Privacy Policy, please do not use the App. We reserve the right to modify or amend the terms of our Privacy Policy from time to time without notice. Your continued use of our App following the posting of changes to these terms will mean you accept those changes. If we intend to apply the modifications or amendments to this Privacy Policy retroactively or to personal information already in our possession, we will provide you with notice of the modifications or amendments.

If you have any questions about this Privacy Policy or don’t see your concerns addressed here, you should contact us by email at privacy@limebike.com.

WHAT INFORMATION ABOUT ME IS COLLECTED AND STORED?

We collect two basic types of information from you in conjunction with your use of the App, personal information and non personal information. Personal information is information that you supply to us, as described more fully below, i.e., when you use our Services, obtain a subscription, complete a survey, register on the App, upload content, participate in a community, or provide your e mail address.



Personal information is any information that can individually identify you and includes, among other things, your name, e mail address, telephone number, postal address, credit card, billing and contact information. Non personal information includes information that does not personally identify you, but it may include tracking and usage information about your location, demographics, use of the App and the Internet.

Personal Information

As a general matter, you can browse the App without submitting your personal information to us. However, there are a number of circumstances in which you may supply us or our agents with your personal information. The following lists the most common ways in which we may collect your personal information.

- Registration for an account on the App
- Use of the account through the App, including rental of a Bike
- Payment information submitted to LimeBike when renting a Bike
- Registration for an event sponsored by LimeBike
- Profile information that You provide for Your user profile
- Social media information that you authorize
- Certain location data, as described below
- Uploading Content to the App
- Submitting an application to work at LimeBike
- Participation in surveys, contests, or sweepstakes
- Sign up to receive alerts or other information via email, text or instant message from LimeBike
- Request for customer service, support requests or other assistance
- App related communications, e.g. account verification; technical notification
- Participation in communities, commenting to blog entries and participation in other forums
- Submission of content or other data and information on any part of the App that permits it
- Any other place on the App where you knowingly volunteer personal information

Non Personal Information

In addition, when you interact with the App, we may collect certain information that does not identify you individually and our servers may automatically keep an activity log of your use of our App (“Non Personal Information”). Generally, we collect and store the following categories of Non Personal Information:

- Non identifiable demographic data such as age, gender, and five digit zip code as part of collecting personal information

- Device information about your computer, browser, mobile device, or other device that you use to access the App. This information may include IP address, geolocation information, unique device identifiers, browser type, browser language, and other transactional information.
- Analytics and usage information about your use of the App, including GPS routes, and status of GPS chips.
- Device information about the LimeBike Bike, including time stamps, battery status.
- Additional “traffic data” and log files such as time of access, date of access, software crash reports, session identification number, access times, and referring App addresses.
- Other information regarding your use of the App.
- Collection of Your Source IP Address/Location Information

We collect and store location information about you on the App and associated with your account that you volunteer on the App or enable through the App or your device. We will collect location information regarding the location of the LimeBike Bikes, the routes taken by these Bikes, and the rental status of these Bikes. We will not collect any location information that you do not volunteer or enable, but you must agree to provide certain location information in order to use the Service. We also collect and store your device’s source IP address which may disclose the location of your device at the time you access the App.

Collection of Personal Information From or Through Social Media Sites or Using Your Social Media Logon

When you interact with any Service Provider page or account on a social media platform, such as Facebook, Twitter, Google , Tumblr, LinkedIn, YouTube, or Pinterest, we may collect the personal information that you make available to us on that page or account including your account ID or “handle.” However, we will comply with the privacy policies of the corresponding social media platform and we will only collect and store such personal information that we are permitted to collect by these social media platforms. If you publish your social media profile on our Service, we may collect personal information that you make available as part of that profile.

Collection of Information From Other Sources

We also may collect information about you that we may receive from other sources or from our offline interactions with you to, among other things, enable us to verify, update information contained in our records and to better customize the App for you. We may also collect Personal Information from credit reporting agencies to, for example, determine your creditworthiness, credit score, and credit usage, in accordance with applicable laws.

Collection of Personal and Non Personal Information Through Surveys and Promotions

From time to time We may provide You with the opportunity to participate in sweepstakes or other promotions on our Service, which might be sponsored or conducted by a third party. If you participate, We will request certain personally information from You. Participation in these sweepstakes and promotions are completely voluntary and You therefore have a choice whether or not to disclose this personal information. The requested personal information typically includes contact information. If there is a third party sponsor involved please make sure to review that party's privacy policy.

Collection of Third Party Personal Information Through Tell A Friend Feature

We may from time to time conduct a referral service to introduce people you know to our Apps and Service. If you choose to use our referral service to tell someone about our Apps and Service or a discount on the Apps and Service, we will ask you for your contact's name and email address. We will automatically send your contact a one time email inviting him or her to visit our App. We store this information for the purpose of sending this one time email and tracking the success of our referral program. Your contact may contact us at [REDACTED] or [REDACTED] to request that we remove this information from our database.

Use of Cookies and Other Tracking Technologies

Like many websites and mobile applications, we use “cookies”, which are small text files that are stored on your computer or equipment when you visit certain online pages that record your preferences and actions. We may also use cookies to monitor traffic, improve the App and make it easier and/or relevant for your use. Like many Apps, we use cookies, web beacons and similar technologies to record your preferences, track the use of our Apps and your exposure to our advertisements. We may also use these technologies to monitor traffic, improve the Apps and make it easier and/or relevant for your use. If you delete your cookies or if you set your browser or device to decline these technologies, some features of the App may not work or may not work as designed.

We use both “session” cookies and “persistent” cookies. We do not use flash cookies, web storage, web beacons or other technology that tracks your browsing history across multiple Apps.

We use cookies for the other purposes set out below:

- We use cookies to remind us who you are and to find your account information in our database when you access a Service so you do not need to log in at every visit. This helps us to provide you with service tailored to your specific needs and interests. A cookie is created when you register for a Service
- We use cookies to determine the browser the visitor uses so the Apps can be designed to work properly with the most common versions of different browsers
- We use cookies in conjunction with sending you e mail newsletters
- Advertisers that place ads on the App may use cookies

- We use cookies in conjunction with analysis of your use of our App and generate analytics regarding our App
- We use cookies to estimate our audience size. Your browser is given a unique cookie that helps us determine whether yours is a repeat visit or a first visit
- We also use Google Analytics, a web analytics service provided by Google, Inc. (“Google”), on our Apps. Google Analytics uses cookies or other tracking technologies to help us analyze how users interact with and use the Apps, compile reports on the Apps’ activity, and provide other services related to Apps activity and usage. The technologies used by Google may collect information such as your IP address, time of visit, whether you are a return visitor, and any referring App. The Apps do not use Google Analytics to gather information that personally identifies you. The information generated by Google Analytics will be transmitted to and stored by Google and will be subject to Google’s privacy policies. To learn more about Google’s partner services and to learn how to opt out of tracking of analytics by Google click [here](#).

We may partner with third party advertising companies to better provide advertisements about our goods and services that may be of interest to you. These third party advertisers may use cookies alone or in conjunction with web beacons or other tracking technologies to collect information about you when you use the Apps. They may collect information about your online activities over time and across different Apps and other online services. They may use this information to provide you with interest based advertising or other targeted content. These online advertising partners do not have access to or use your name, address, e mail address, telephone number or other personally identifiable information from us, without your consent. They may, however, use persistent identifiers to anonymously track your Internet usage across other Apps in their networks beyond these Apps. While we restrict their further use of such information, such third parties may, with sufficient data from other sources, be able to personally identify you, unknown to us.

Third party ad serving companies and other unaffiliated advertisers also display advertisements on our Apps. As part of their service, they may place a separate cookie on your computer or utilize other data collection and tracking technologies, to collect information such as your IP address, browser type, the server your computer is logged onto, the area code and zip code associated with your server, and whether you responded to a particular advertisement. For a listing of the third party companies we may allow to place cookies to serve ads on the Apps, click [here](#). We do not control these third parties’ tracking technologies, how they may be used, or the information they may collect and we are not responsible for the privacy policies or the content of those third parties. Please visit the sites of those businesses at the links above to review their privacy policies. We may add or change the list of third party ad servers from time to time and we encourage you to check this section for changes. You can learn more about online advertising at www.aboutads.info/consumers.

Many of the third party advertisers that place tracking tools on our Apps are members of programs that offer you additional choices regarding the collection and use of your information. You can learn more

about the options available to limit these third parties' collection and use of your information by visiting the Apps for the Network Advertising Initiative and the Digital Advertising Alliance, as well as the webpages for Facebook's ad preferences tool and privacy policy.

Similarly, you can learn about your options to opt out of mobile app tracking by certain advertising networks through your device settings. For more information about how to change these settings for Apple, Android or Windows devices, see:

- Apple: <http://support.apple.com/kb/HT4228> do
- Android: <http://www.google.com/policies/technologies/ads/>
- Windows: <http://choice.microsoft.com/en-US/opt-out>

Please note that opting out of advertising networks services does not mean that you will not receive advertising while using our Apps or on other Apps, nor will it prevent the receipt of interest based advertising from third parties that do not participate in these programs. It will, however, exclude you from interest based advertising conducted through participating networks, as provided by their policies and choice mechanisms.

Your browser or device may include "Do Not Track" functionality. Because a "Do Not Track" compliance protocol has not yet been finalized, LimeBike's information collection and disclosure practices, and the choices that we provide to customers, will continue to operate as described in this privacy policy, whether or not a Do Not Track signal is received.

How Do We Use Your Information?

We use the information we learn from you to help us personalize and continually improve your experience on the App. We may use your Personal and Non Personal Information in the following ways:

General Uses

- To provide the LimeBike Service to you as you request
- To track the Bikes
- To upload your content to our App as you request
- To permit you to update, edit, and manage your content on our App
- To communicate with you about your account or transactions with us (including service related announcements) and send you information about features and enhancements on our App
- To communicate with you about changes to our policies
- To communicate with you about your comment to a blog post
- To personalize content and experiences on our App, including providing you reports, recommendations and feedback based on your preferences
- To disclose anonymized Personal Information to disclose statistics and analytics and other details regarding the use of our App.
- To optimize or improve our products, services and operations

- To automatically update the App on your device
- To detect, investigate, and prevent activities that may violate our policies or be illegal
- To perform statistical, demographic, and marketing analyses of users of the App

Use of Your Location Information

- Specifically, we use your location information to:
- Track the use of the LimeBike Bikes
- Personalize content on our App, including providing you reports, recommendations and feedback based on your preferences
- Optimize or improve our products, services and operations
- Detect, investigate, and prevent activities that may violate our policies or be illegal
- Perform statistical, demographic, and marketing analyses of users of the App and their purchasing patterns
- Combination of Your Personal Information

We use the information from one portion of the App on other portions of the App or elsewhere in our network of Apps, apps, and other interactive features, or in reports and analysis, all of which are owned and operated by LimeBike, and we may combine information gathered from multiple portions of the App into a single customer record or analysis or report. We also use and/or combine information that we collect off line or we collect or receive from third party sources to enhance, expand, and check the accuracy of your customer records.

Who Do We Provide Your Information To?

Except as disclosed in this Privacy Policy, we do not disclose information about your Personal Information collected online to any companies not part of LimeBike or its parent, subsidiaries or related entities. In no event will we sell or rent your Personal Information as part of a customer list or similar transaction.

Business Partners, Sponsors and Third Parties

We may share your Personal Information with our sponsors and other business partners from time to time. You may withdraw your consent to our sharing of your Personal Information with business partners and third parties at any time by following the opt out process described below.

Third Party Agents

We have third party agents, subsidiaries, affiliates and partners that perform functions on our behalf, such as hosting, billing, push notifications, storage, bandwidth, content management tools, analytics, customer service, fraud protection, etc. These entities have access to the Personal Information needed to

perform their functions and are contractually obligated to maintain the confidentiality and security of that Personal Information. They are restricted from using, selling, distributing or altering this data in any way other than to provide the requested services to the App.

Emergency Situations

We may also use or disclose Personal Information if required to do so by law or in the good faith belief that such action is necessary to (a) conform to applicable law or comply with legal process served on us or the App; (b) protect and defend our rights or property, the App or our users, and (c) act under emergency circumstances to protect the personal safety of us, our affiliates, agents, or the users of the App or the public. This includes exchanging information with other companies and organizations for fraud protection.

What Steps Are Taken To Keep Personal Information Secure?

We are concerned about ensuring the security of your Personal Information. We exercise great care in providing secure transmission of your information from your device to our servers. Personal Information collected by our App are stored in secure operating environments that are not available to the public. Our security procedures mean that we may occasionally request proof of identity before we disclose your Personal Information to you. Please understand, however, that while we try our best to safeguard your Personal Information once we receive it, no transmission of data over the Internet or any other public network can be guaranteed to be 100% secure.

How Can We Transfer Your Personal Information?

Your information collected through the App may be stored and processed in the United States or any other country in which LimeBike, its Clients, Affiliates or service providers maintain facilities. LimeBike, its Clients, Affiliates, or service providers may transfer information that we collect about you, including personal information across borders and from your country or jurisdiction to other countries or jurisdictions around the world. If you are located in the United States or other regions with laws governing data collection and use that may differ from US law, please note that we may transfer information, including personal information, to a country and jurisdiction that does not have the same data protection laws as your jurisdiction. Wherever your personal information is transferred, stored, or processed by LimeBike, LimeBike will take reasonable steps to safeguard the privacy of your personal information. By registering for and using the App you consent to the transfer of information to the US or to any other country in which LimeBike, its Clients, Affiliates or service providers maintain facilities and the use and disclosure of information about you as described in this Privacy Policy.

How Long Do We Keep Your Information?



Following termination or deactivation of your account, LimeBike, its Clients, Affiliates, or its service providers may retain information (including your profile information) and user Content for a commercially reasonable time for backup, archival, and/or audit purposes. If you have any questions about termination or deactivation of your account, please contact us directly at [REDACTED] or [REDACTED]

What Happens When I Link To or From Another App?

This App may contain links to other Apps operated by third parties. Please be advised that the practices described in this Privacy Policy for LimeBike do not apply to information gathered through these other Apps. We are not responsible for the actions and privacy policies of third parties and other Apps.

Governing Law

This App is published in the United States. We attempt to protect the Personal Information of all users of our App and we attempt to comply with local data protection and consumer rights laws to the extent they may apply to the Services, but our App is located and targeted to United States citizens and our policies are directed at compliance with those laws. If you are uncertain whether this privacy policy conflicts with the applicable local privacy laws where you are located, you should not submit your Personal Information to LimeBike.

Assignment

We may change our ownership or corporate LimeBike while providing the App. We may also sell certain assets associated with the App. As a result, please be aware that in such event we may transfer some or all of your information to a LimeBike acquiring all or part of our assets or to another LimeBike with which we have merged. Under such circumstances we would, to the extent possible, require the acquiring party to follow the practices described in this Privacy Policy, as it may be amended from time to time. Nevertheless, we cannot promise that an acquiring LimeBike or the merged LimeBike will have the same privacy practices or treat your information the same as described in this Privacy Policy.

Changes to This Policy

As our App continues to develop, we may add new services and features to our App. In the event that these additions affect our Privacy Policy, this document will be updated appropriately. We will post those changes prominently so that you will always know what information we gather, how we might use that information and whether we will disclose it to anyone. We do, however, recommend that you read this Privacy Policy each time you use our App in case you missed our notice of changes to the Privacy Policy. We will not, however, materially change our policies and practices to make them less protective of Personal Information we have previously collected from you without your express consent.



WHAT ARE YOUR CHOICES AND HOW DO YOU OPT OUT?

We believe you should have choices about the collection, use and sharing of your information. Although you cannot opt out of all data collection when you visit our Apps, you can limit the collection, use and sharing of your personally identifiable information.

Collection of Personal Information. All personally identifiable information is provided on a voluntary basis. If you do not want LimeBike to collect such information, you should not submit it to the App. However, doing so will restrict your ability to access some content and use some of the functionality of the App.

Emails and Other Communications. If you would like to alter the type of communications you receive from us, including opting out of promotional communications from us, you may do so at any time by updating the communication preferences specified in your account profile through the App. Please note that this may affect your ability to access certain products and services, and we may continue to send non promotional communications such as staffing confirmations, surveys, and other information about your use of the Service. If you refer others to us using our email functionality, please note that they may choose not to receive any promotional emails from us in the future by following the opt out instructions in the email invitation.

Tracking. You also have choices to limit some tracking mechanisms that collect information when you use the App. Many web browsers automatically accept cookies, but you can usually modify your browser's setting to decline cookies if you prefer. If you choose to decline cookies, certain features of our App, including the App themselves, may not function properly or remain accessible to you. In addition, you may also render some web beacons unusable by rejecting or removing their associated cookies. Note that if you choose to remove cookies, you may remove opt out cookies that affect your advertising preferences. For more detail on your ability to opt out, see [Use of Cookies and Other Tracking Technologies](#) above.

Please note that while you may opt out of online behavioral advertising and other targeted advertising served by participating companies through App you may still see other types of advertising on the App, it just may not be as relevant or targeted to your interests.

Accessing and Correcting Your Information. If you have an account with LimeBike, you may review and change your information by logging into your account and editing your profile. Be advised that we may not be able to delete your Personal Information without also deleting your user account. You will not be permitted to examine the Personal Information of any other person or entity and may be required to provide us with Personal Information to verify your identity prior to accessing any records containing information about you. We may not accommodate a request to change or delete Personal Information if we believe doing so would violate any law or legal requirement, or cause the information to be incorrect.

If you have any questions about this Privacy Policy, you should contact us by email at [REDACTED] or [REDACTED].

Your California Privacy Rights

California Civil Code Section 1798.83 permits customers of LimeBike who are California residents to request certain information regarding its disclosure of their personal information to third parties for their direct marketing purposes. To make such a request, please send an e mail to [REDACTED] or [REDACTED]

Additional Attachments (USB key)

- Insurance Documentation
- Unit Inventory List
- CPSC certification:
 - speed bike
 - 3 speed bike
 - 8 speed bike
 - E Assist bike
 - Note: There is no CPSC certification equivalent for electric assist scooters. We will gladly share with you the results of our internal testing, but no U.S. government recognized test currently exists.
- ISO testing results:
 - speed bike
 - 3 speed bike
 - 8 speed bike
 - E Assist bike
 - Note: There is no ISO equivalent for electric assist scooters. We will gladly share with you the results of our internal testing, but no internationally recognized test currently exists.
- Scooter Certifications

Past performance for Lime permit application
(Note: applies to both scooter and e-assist applications)

On Page 1 of the application it reads:

Has your company been fined or had property impounded by the City of Austin and/or any adjacent cities or counties?

Lime response: Lime previously deployed a number of electric assist scooters in the City of Austin. The city of Austin impounded 60 of Lime's scooters. The city assessed a fee of \$230 per scooter in labor costs per scooter for a total of \$13,800. Lime has submitted payment to the City. Please contact Sam Sadle at (202) 641-6162 if you have any questions.

Certificate of Compliance



No. 0H180206.ZOV0Q42

Test Report no. XMT0201704830L/MD, XMT0201704831L/LVD, XMT0201704832L/EMC

Certificate's
Holder:

ZHEJIANG OKAI VEHICLE CO., LTD.
No. 9, Xinxing Road, Xinbi Town, Jinyun County,
Zhejiang, China

Certification ECM
Mark:



Product:
Model(s):

Electric Scooter
ES09, ES09-A, ES09-B, ES09-C, ES09-D, ES09-E,
ES09-F, ES09-G

Verification to:

Standard:
EN ISO 12100:2010,
EN 60204-1:2006+A1:2009+AC:2010,
EN 15194:2017, EN 12184:2014,
EN 61000-6-1:2007,
EN 61000-6-3:2007+A1:2011,
EN 61000-3-2:2014, EN 61000-3-3:2013

related to CE Directive(s):
2006/42/EC (Machinery)
2014/35/EU (Low Voltage)
2014/30/EU (Electromagnetic Compatibility)

Remark: The product(s) has been verified on a voluntary basis. The product(s) satisfies the requirements of the Certification Mark of ECM, in reference to the above listed Standard(s). The above Compliance Mark can be affixed on the product(s) accordingly to the ECM regulation about its release and its use. The regulation can be found at www.entecerma.it. This Certificate of Compliance can be checked for validity at www.entecerma.it

This verification doesn't imply assessment of the production of the product(s).

Additional information, clarification about the **CE** Marking:



We attest that a TCF for the **CE** Marking process is in place. Whereas the Manufacturer is Responsible to start the **CE Marking Certification Procedure** and to perform all the necessary activities, as required by the Directive before placing the **CE** Mark on the product(s).

Date of issue 06 February 2018

Expiry date 05 February 2023

Chief Manager
Marco Morini



Deputy Manager
Amanda Payne



Ente Certificazione Macchine Srl

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